Electrical World

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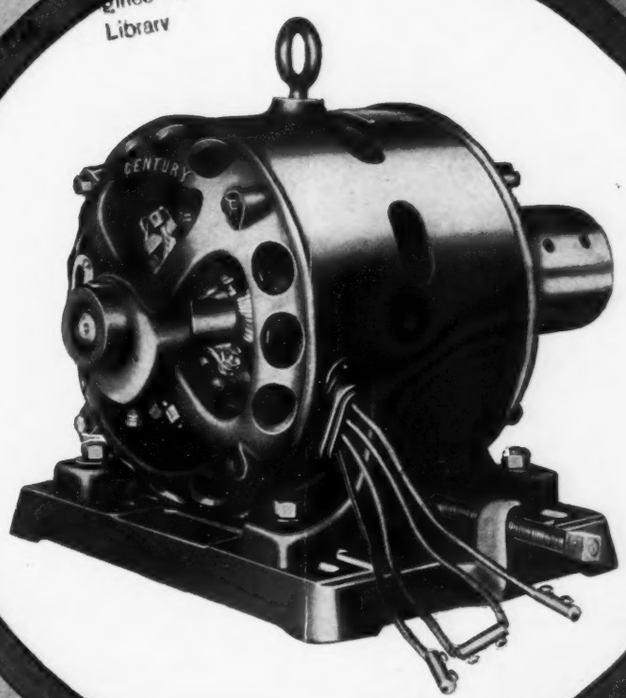

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Electrical World

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Fuel Conservation Still Necessary

THE ELECTRICAL WORLD deems it of highest importance to the nation that fuel resources be conserved without delay. These resources are definitely limited. They are irreplaceable. They are of great and increasing value. They are being wasted. While they are being depleted steadily we have no national program, no public concern over the situation. Scientists, economists, publicists warn the nation from time to time. Nothing is ever done. Congress, lost in a maze of politics, fails to grasp the problem. No more important duty confronts the engineer than to awaken the public mind to our shiftless lack of national policy. Potential water power should be put to productive use promptly.

Shifting gears from a war to a peace basis may jar our industrial mechanism a bit, but this is no time to lose one's head, condemn the 1919 model and jump out of the car into the quicksand of pessimism. Plan, order, contract as opportunity permits, and watch the bus accelerate into undeniable stable prosperity.

Government and Industry

THE electrical industry gave its whole-hearted support to the government in the war. It knew how difficult and how vast the war work was and instinctively sympathized with those on whom the responsibility fell. Something important had to be done and it was of no consequence who did it or who got the credit. Men volunteered from all branches. Manufacturers turned over their entire plants and research departments, public utilities refused service to others so that the government should not want, and there was neither semblance nor suspicion of profiteering in the work of any branch. All served patriotically and willingly, spurred on by the greatness of purpose which animated the nation. We mention this lest there should be a tendency to overlook or forget it. Those in authority in Washington happily appreciate the part played by industry and indicate a willingness to meet the problems brought on by the sudden termination of the war without unduly disturbing the supply markets or productive labor. There is even a disposition to help keep up production by offering shipping and other advantages for export trade. Thus the war has not been altogether without recompense to peaceful industries like ours. The government and the people have seen a light and are inclined to deal fairly with the manufacturing and supply industry, more so now than ever. There is therefore no reason for pessimism or doubt. The same spirit of coöperation which won the war can be relied on to solve present problems.

Public necessity is a wonderful shock absorber in times of business transition. Electrical service is a peace essential as well as a war requirement, and the supply of that service can no more be stopped in civilized countries than waterfalls can be reversed by human hands.

Hydro Development in California

A SURVEY of the economic and financial conditions surrounding power development in the State of California discloses four important facts—one, the desirability of conserving fuel oil through hydroelectric developments; two, the necessity of additional power in the central and northern part of the state for meeting the requirements for irrigation projects, industrial growth and the normal increase in power demands; three, a fear in some sections of the restrictions which are supposed now to obtain under the regulations of the Departments of Agriculture and the Interior, and, four, the control of these hydroelectric power companies by the above-mentioned departments and the Railroad Commission of the State of California.

It is obvious that more than a million barrels of oil per annum can be saved by additional efficient hydroelectric developments. The oil usage in 1918 has increased by 700,000 barrels over the consumption of 1917 for three of the companies serving the industrial district in San Francisco and its environs. A similar situation obtains in the southern part of the state and in the San Joaquin valley. If the power companies can secure the necessary funds with which to make developments, such economies should result that a considerable increase in return can be made on present and prospective investments. It is hoped therefore that early steps can be taken to start the developments outlined in Major Sever's report so that the electricity will be available within the time program mentioned. The indications are that industrial development in that part of the Pacific Coast is going to be greatly accelerated, and that will call for additional and large amounts of electric power. The Railroad Commission has brought about some slight relief by ordering the interconnection of some of the existing systems and the installation of additional steam generating equipment, but this has helped to deplete an already too scant oil supply and unless further hydroelectric developments are made the

situation threatens to become worse. Most of the water power on the Pacific Coast being on the public domain, the speedy enactment of pending water-power legislation is very desirable.

Discrimination against the individual customer by reduced lighting rates to municipal buildings should be discarded in progressive communities where the square deal exemplifies the relationship between public utilities and all classes of energy consumers from the cigar stand up.

Industrial Lighting as an Engineering Problem

ARTIFICIAL illumination bears a vital relation to quantity and quality of output so that its economic aspect is a very important one. From a practical standpoint the question is continually one between cost and result, but if the researches of the last two years have shown anything, they have proved that up to some indeterminate point, beyond present practice in lighting, improved illumination pays. The fundamental object of the lighting codes adopted by various states is to secure good working conditions for the employee, but incidentally they benefit the employer in at least equal measure. From an engineering standpoint there is no royal road to good lighting. Under given conditions to be maintained indefinitely a comparatively simple prescription is sometimes effective, and attempts have been made to systematize methods of lighting so that a few simple rules will lead to thoroughly good results. As a matter of practice, the case stands quite otherwise; for only in the minority of cases is a working space used continually for the purpose for which it was originally designed. Some of the worst cases of bad lighting to be found anywhere are those in which the original scheme was good but has been rendered useless or inadequate by changes in the character of work done or subdivision of the space illuminated. It is the task of the illuminating engineer to treat industrial lighting not by cut and dried formulas but by acute judgment as to what is the best thing to be done under circumstances, not as they were some years back, but as they are now with the space applied to its actual purposes. Panaceas in illumination are about as ineffective as they are in medicine.

With the war behind us, let us take a firmer hold upon the steering wheel of progress and throw our efforts into high gear, lest our competitors show us their tail-lights and we lose our way in the dust of the more courageous!

A Tale and a Moral

WITHIN a year thousands of persons have learned for the first time the joy and the power of coöperative effort. Personal and business considerations have been subordinated to national policy. Duty, far-reaching in its scope and yet intimate in its appeal, has been realistically presented to each of us, and we have been made to feel that we are a part of a great nation and that that nation's welfare is in our keeping. James Burke tried to inject a somewhat kindred spirit into the meeting of the Electric Power Club in Cleveland last week. He seeks to remove motor manufacture from the field of drudgery to that of pleasure and profitableness through uniformity of design. The personal jealousies and petty ambitions of manufacturers and designers have no place in his program. He deals with the problem of motor design in the light of great ideals and seeks to perpetuate the lessons learned in war time to the mutual profit of maker and user both. A dream he calls it, and yet it needs only coöperative effort within the electrical industry and the subordination of a very few things to that industry's welfare to make the dream come true. Mr. Burke's address is printed in full, and the story is so well told that its reading will give both pleasure and profit.

Worry over the future course of prices, hesitation to undertake intrinsically meritorious projects and resultant stagnation in fear of an abnormal overhead have little place in a nation like this. One hundred million people are not going to commit industrial harikari because prices recede so slowly. Deliveries and service as well as current quotations will control sales in the business of the great era which we have entered.

Apparatus for Arc Welding

THE paper by Otis Allen Kenyon on recent welding systems gives an admirable summary of present conditions. Arc welding as a method of metal working has become so important in the past few years that it has really grown to be an important branch of engineering. As generally happens in electrical practice, no universal solvent of the difficulties of the situation appears, and the choice of apparatus becomes to a large extent a matter of suitability to the task in hand. To make a very general classification of the requirements of arc welding, they fall broadly into two groups, one of them involving work varying widely in kind, in thickness, shape and material to be dealt with, the character and location of the welds required. This, so to speak, is the engineering side of the art. The second is the use of arc welding in a manufacturing process where it becomes one of the tools of quantity production and has to meet the requirement of performing similar operations over and over again with the maximum speed and certainty, as close to automatic action as conditions permit.

Now, as a study of Mr. Kenyon's admirable paper shows, this division of the work must lead to different requirements in the apparatus, and does do so in fact. For the former uses accurate control of the welding process in the hands of a skilled workman is sometimes all-important, and if it can be attained, even at the cost of somewhat heavy and expensive apparatus and inefficient use of the energy, it is still exceedingly worth while. In other cases it is profitable to plan for a higher degree of automatism in the operation, even at considerable trouble, in order to avoid depending too much on the judgment of the workman in cases which require not so much extreme precision as a good and uniform job; hence the variety of lines on which the problem of designing welding apparatus has been approached and the considerable differences in detail that present themselves. The plans of operation range all

the way from a multiple system, with great flexibility in the control of individual welders, to, for the case of quantity production work, a constant-current series system which with proper attention almost runs itself in the repetition of a series of like operations.

The various classes of apparatus leading to these results Mr. Kenyon admirably describes, together with some of their special working properties. Several of the systems in use, and successful use at that, demand a separate generating equipment for each individual arc, and for certain classes of work this is not an objectionable feature if thereby energy can be saved and work facilitated. The alternating-current arc-welding system, with its relatively light transformers and covered electrodes, represents an ingenious attempt to escape the limitations just mentioned. It is interesting to note that the various types of apparatus employed involve properties of regulation closely similar to those which much earlier appeared in arc-lighting practice. Indeed, at the bottom of each case lies a similar requirement, that a stable and uniform arc should be produced with the minimum cost and complication of apparatus. As in lighting, so in welding, both constant-potential and constant-current systems are in use to the same end, and, as in lighting also, it is altogether likely that each system will find its own particular field of application to which its properties are especially suited. Certain it is that the art of arc welding has come to stay and to bring increasing usefulness in the working of metals, and we are glad to present to our readers so good an account of the present situation as it has been developed in recent years and at the hands of engineers with different viewpoints and lines of attack.

Place that order to-day if your stock shows signs of running low and do not wait in timid uncertainty for the drop in prices which you have been expecting daily since Foch booted Hindenburg nach Berlin. Mayhap you could turn over your new investment two or three times before you lose a dollar and make enough en route to show healthy net.

Government by Law or by Man?

BY A VERY easy process the administration has taken and held complete operation of several of the great groups of utilities. There was a war, Congress passed laws to give the administration what it asked to prosecute the war, the war was ended, but the administration clings to its firm grasp of the railroads and communication systems. What does the man in the street think about it all? His mental methods are ordinarily simple and direct. He is beginning to get some light on the question of what is being done at Washington. The latest developments are illuminating to his clear reasoning. There was a flare of trumpets and the announcement of a new schedule of telephone rates. People were given or got—it doesn't really matter which or how—the impression that rates were to be reduced. What were the facts? Representatives of nineteen state public utility commissions met in Chicago last week and passed a resolution declaring that the Postmaster-General had exceeded his legal powers. They apparently objected strenuously to the proposed change in intrastate rates, which was increase instead of decrease. A number of states have already acted to investigate or nullify the higher rates which the Washington authorities sought to levy. The Illinois commission has ordered suspension of the new schedule for 150 days. In Massachusetts the commission announced that it would not put the new rates into effect until the conclusion of hearings begun on Jan. 19. The Michigan commission declined to give immediate approval to the rates, holding that the companies have neither advertised them sufficiently nor published their application for hearing as required by the Michigan law. The Ohio commission rejected the rates on the ground that they were excessive and had been made without due investigation. The Florida commission asked a court restraining order against the rates, though the Washington telephone authorities say that it was denied. Nebraska, New Jersey, Missouri, West Virginia, Nevada, Arizona, Connecticut object to the scheme. This is an effective voice of protest. It is an expression from Mr. Common Citizen.

The states created their public service commissions to regulate the charges for public utility service. Do they surrender this power to the federal government in time of war? The answer is, yes, they did so. When they are asked to abandon the exercise of their power after the war is over in the interest of a public ownership policy ardently exploited by a Cabinet officer they see that a new question is involved. Entirely outside of the issue of government operation the question of states' rights is raised. Suppose that the states, loyal to the government in war, feel that they are better fitted to determine what is in the interest of their communities than an autocratic official in Washington. Assume that their point of view is that they are satisfied that they can get what physical development of utility service they need so long as they have power to regulate, but that they are very doubtful of getting such development if they have to deal with an arbitrary power at the national capital. No, the states are not yet ready to throw aside the system of regulation under which they are watching utility services and rates within their borders.

This is a government of law, not of men. It is a government of principles, of ideals if you like, but not one in which arbitrary individual power rules. The function of the individual is the administration of the law, obedience to its letter and spirit. The present telephone policy rests, so far as it has any sanction of law, upon an act of Congress passed to centralize authority in Washington for the purpose of waging war. Neither in law nor in the declared policy of the people is there justification for government operation of the telephones after the final settlement of the war. Technically speaking, peace has not been signed. But there is not room for much difference between a peace that is not signed and a war that, in the President's words, has come "to an end." If government operation without state regulation is to be substituted for private operation with regulation, the states have shown plainly through their commissions that they don't like it. If the system of regulation by law is to be supplanted by a system of arbitrary determination by men clothed with brief authority, the state commissions have shown that they cannot approve of the change.

Standard Testing Code for Hydraulic Turbines

To Avoid Disputes Over Hydraulic Turbine Performance a Simple Testing Code Recognized by Manufacturers and Operating Companies Should Be Agreed Upon—Engineering Societies Are Urged to Adopt Code of the Machinery Builders' Society

BY F. H. ROGERS
Hydroelectric Engineer I. P. Morris Department of William Cramp & Sons Ship & Engine Building Company

THE need of a standard testing code for hydraulic turbines has long been recognized by the engineers of operating companies and manufacturers. Until recently no such standard or generally accepted code was in existence, so that often disputes arose as to the performance of the turbines or the actual hydraulic conditions existing in the plant. In order to avoid the possibility of such disputes, it is important that both purchaser and manufacturer have a clear understanding and agreement on all the conditions entering into the contract. Such a result is best accomplished by the previous acceptance by both parties interested of a standard testing code which not only protects the purchaser in that he knows ahead just what he is buying but also protects the manufacturer in that he knows definitely the exact conditions for which he is to design the machinery.

In order that such a code may become standard and universal, it is necessary that it be of so broad a character that it covers the conditions entering into all contracts for hydraulic turbines. In preparing such a code it is realized that the turbine is but a part of the entire hydroelectric installation, and therefore the particular conditions applying to it must be separated from the general conditions applying to the whole installation. Thus, for example, the efficiency of the plant may be considered to be the electrical output from the transformers divided by the total potential water horsepower as calculated from the total flow of water through the turbines and other auxiliary machinery together with any leakage and spillway discharge, and the total head as measured from the still-water levels in the headrace and tailrace. The efficiency of the hydraulic turbine, on the other hand, is the horsepower output at the turbine shaft divided by the water horsepower supplied to the turbine, as calculated from the actual quantity of water flowing through the turbine and the effective head measured at the unit.

What the Code Should Contain

It is evident therefore that the code should contain exact definitions of the mechanical and hydraulic elements entering into all contracts, such as horsepower output, quantity of water, effective head, water horsepower and turbine efficiency.

It is equally important that the code should clearly state the methods of tests or the exact means of determining in actual performance whether the turbine has met its contract guarantees.

The preparation of such a code requires a very careful investigation of the methods used in current practice and should be based on the opinions and experience of the leading engineers and manufacturers in the hydroelectric field. The impossibility of the agreement of all engineers on all points covered is admitted, but where disputed points may exist standardization of method is more important than absolute accuracy, as it results in a definite basis for turbine contracts and avoids disputes.

The A. S. M. E. Code

Some time ago the power test committee of the American Society of Mechanical Engineers prepared a report on "Rules for Conducting Performance Tests of Power-Plant Apparatus" which was published in the *Transactions* of the society for 1915. This report contained a section on testing waterwheels which was so incomplete and inadequate that it did not in any way cover the subject as called for by modern conditions in this field of engineering, and hence has never been referred to in actual practice. To substantiate the above statement consider the following examples taken from the code:

Power Output.—It is stated that where the turbine drives an electric generator the power output is measured by calculation from the electrical output. No definition is given, however, of the generator efficiency or the method of obtaining it on large machines in the field. This point is of great importance as the output of the turbine is the output of the generator plus all losses supplied by the turbine, and hence methods should be stated for determining the efficiency of the generator, considered as a dynamometer, under the conditions existing in the turbine test. References are made in the code to correcting for excitation losses which are not at all clear. This point is easily settled when a definition of generator efficiency is given which specifies the losses to be considered.

Water Measurement.—The method given the greatest prominence is by means of floats in the headrace or tailrace. This means of measurement can be applied only to a very limited number of cases where a canal of the necessary length is available, but even in such cases it is very inaccurate and should only be used where approximate results are sufficient. Mention is also made in the code of current meters, weirs and pitometers, but very little detail is given as to these methods, which are far more accurate than floats.

In the appendix to the code it is stated that for measuring the flow a current meter of the cup type is quite satisfactory and may be calibrated by moving the meter through still water. It is well known, however, that the particular meter mentioned is not the most accurate type and that results based on its still-water rating are under usual conditions seriously in error.

Under the heading of "Weirs," it is recommended that the Francis formula be used. As stated in the code, however, this formula is correct only when applied to a weir built to the dimensions used by Francis and for the ranges in head used in his experiments. The use

of a weir, therefore, according to this code is limited to small units. No mention is made in the code as to methods of measuring the flow through turbines supplied with metal penstocks or concrete intakes, which type is by far the most common in modern plants.

Head.—The head is stated as the difference between the levels in the flume and discharge pit as measured by graduated scales. Such a definition applies only to turbines set in open flumes, which type comprises a very limited class not considered modern practice. Under a footnote in the code a method is given for measuring the head on wheels supplied through penstocks. This method should be given the prime consideration due to its general application in modern practice. No correction is made in the code for the outflow loss at the discharge of the draft tube, so that apparently this loss is charged against the turbine. As it is necessary to get rid of the water used by the turbine, a certain velocity must exist at the discharge of the draft tube, which should be considered as a tailrace loss and hence credited to the turbine.

Instructions.—There is no mention made in this code as to the actual methods of testing the turbines, and no instructions are given as to the variations which should be allowed in the hydraulic conditions during the test or the means of correcting for such variations. In short, the code does not cover any of the difficulties which usually arise in tests of hydraulic turbines and therefore cannot possibly settle any disputes which are likely to arise between the manufacturer and the purchaser.

CODE OF THE MACHINERY BUILDERS' SOCIETY

About a year ago the question of drawing up a suitable testing code was taken up by the leading manufacturers of hydraulic turbines. This work was done, under the auspices of the Machinery Builders' Society, by a committee composed of representatives of the turbine manufacturers of which H. Birchard Taylor was chairman. Many meetings were held by this committee during a period of nine or ten months, with the result that a testing code was drawn up which had the approval and acceptance of all the manufacturers. Preliminary copies of this code were sent to the most prominent engineers in the hydroelectric field in this country and in Canada in order to obtain their advice as to possible revisions and their approval of the code as a whole. Many valuable suggestions were obtained from these engineers which were incorporated in the final form of the code.

To review this code briefly, it may be stated that its primary feature is to define clearly all of the elements entering into the performance of hydraulic turbines and to specify definitely the means of determining this performance by tests in place, in order that no disputes can arise between the manufacturer and the purchaser as to the carrying out of the terms of the contract. For example, consider the same elements discussed in the A. S. M. E. code.

Power Output.—The code carefully defines the generator efficiency and the method of determining this efficiency under the test conditions, so that the power output of the turbine can be accurately obtained. The code also takes care of the question of excitation load by omitting this loss in the determination of the generator efficiency. Therefore, for separate excitation, this loss is omitted in computing the turbine output, and in cases where the exciter is mounted on the unit shaft it is considered as a separate generator driven by the turbine, and its kilowatt output divided by its efficiency is added to the turbine output as calculated from the main generator.

Water Measurement.—Under this heading the principal methods are described in some detail, as it is realized that this is the most difficult of all the measurements to be made. Measurement by weir is given considerable space and a formula presented derived from the averages of values computed by the most reliable formulas and data obtainable at the present time. The code is definite as to the dimensions of the weir and channels, the head on the crest and the velocity of approach.

Under the current-meter method of measuring discharge, the code explains how the errors in the readings may be determined by the simultaneous use of two different types of meters which have been previously calibrated so as to obtain data for correcting the readings during the tests.

The Pitot-tube method, which is generally used in the case of turbines fed through steel penstocks, is described very fully, and details are given as to the number and location of tubes and peizometers required. The method of plotting the results is described, and the correction coefficient by means of which the mean velocity is obtained is given.

Other methods, applicable under special conditions, for measuring the flow, such as the screen or diaphragm method, the titration or chemical method, the color velocity method, the brine velocity method, etc., are briefly described and their limitations given.

Head.—An exact definition of the effective head and the means of measuring it are given both for incased turbines and those in open-flume settings. The velocity corrections to be made to the head both at the intake to the casing and at the discharge of the draft tube are fully explained.

Instructions.—This code also goes into the matter of varying conditions which usually occur in tests on hydraulic turbines and definitely limits the allowable variations of load, head and speed. It explains how to make corrections in the results obtained where the head is not the same as that mentioned in the contract, in order that the actual performance of the turbine may be properly compared to the guarantees of performance in the contract.

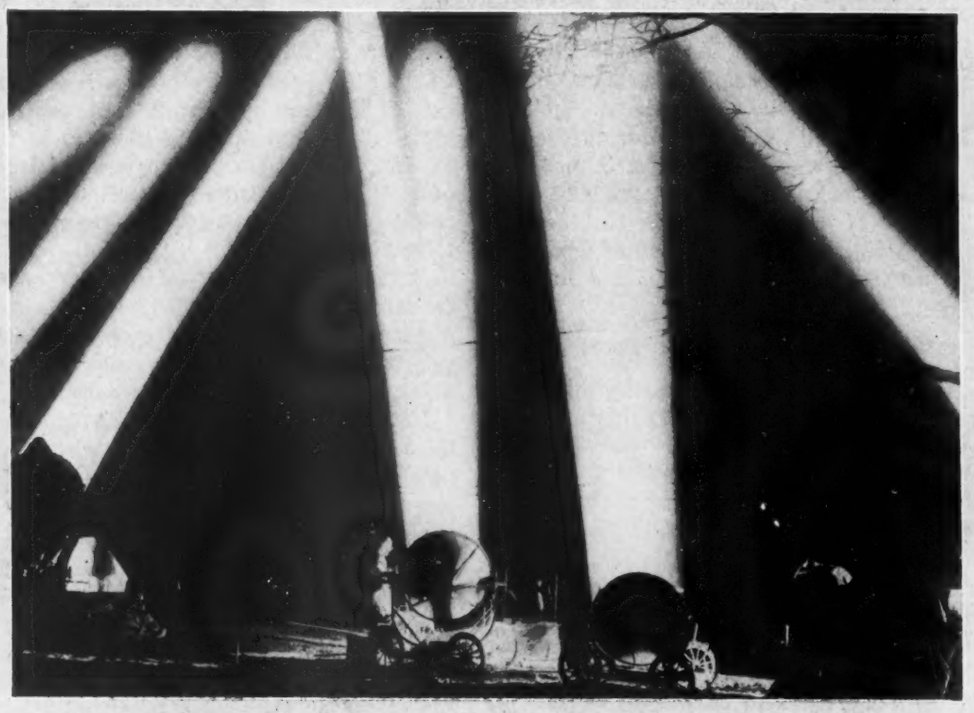
This code was approved by the Machinery Builders' Society on Oct. 11, 1917, and is now being used in connection with all turbine contracts by the following manufacturers: The William Cramp & Sons Ship & Engine Building Company, I. P. Morris department; the Wellman-Seaver-Morgan Company, the Allis-Chalmers Manufacturing Company, the S. Morgan Smith Company, James Leffel & Company, the Pelton Water Wheel Company, and the Platt Iron Works Company.

At a special meeting which was held in December, 1917, in New York City by the American Society of Mechanical Engineers to consider the question of revising the power test codes, the machinery builders' code was presented to the society with the recommendation that it be adopted as the best available code for the testing of hydraulic turbines. While no action was

taken on this recommendation, a sub-committee of the power test committee was appointed by the American Society of Mechanical Engineers to meet with committees from the American Society of Civil Engineers, the National Electric Light Association and the American Institute of Electrical Engineers to draw up a revised code for the testing of hydraulic turbines. No code has as yet been submitted by these committees and in the meantime the machinery builders' code is now in general use in connection with all important contracts for hydraulic turbines.

NEED OF CODE WILL CONTINUE TO INCREASE

The point which the writer wishes to make is that water-power development and extension of plants is almost certain to increase now that attention can be given to expansion, and especially since Congress has had it forcibly brought to mind that national interest demands utilization of water power. As a result the need of a standard testing code will be felt more than ever before by purchasers of hydraulic turbines, as their acceptance of the machines depends on tests made at site. A complete and suitable working code which has the approval of both the manufacturers and the most prominent engineers in the hydroelectric field exists in the form of the "Machinery Builders' Testing Code," so that it only remains for the national engineering associations which are interested in water turbines formally to adopt this code, embellishing or revising it where necessary. In order to expedite this work, the coöperation of turbine users or engineers having to do with the purchase of waterwheels should be given without stint, for the need of a national code of this character will be greatly felt in the readjustment period ahead.



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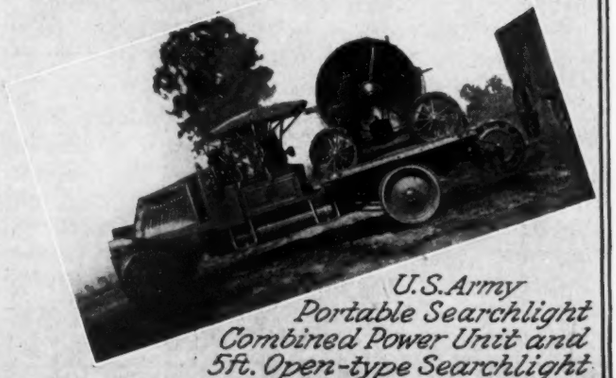

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Searchlight Equipment in Use by the United States Army

Arc-Welding Systems

Rapid Advancement of Arc-Welding Practice Makes a Thorough Understanding of the Fundamental Principles Essential—Welding Systems Are Discussed in a Broad Way, Showing Advantages and Special Usefulness of Each Method

BY OTIS ALLEN KENYON
Chief Engineer Arc Welding Machine Company

IN THE last five years arc welding has made greater advances toward the practical realization of its potential value than were made in the previous twenty-five years, and we are on the threshold of even greater things in the near future.

In the present article the fundamental principles of arc welding are broadly treated, giving due consideration to the physical laws underlying welding practice. It is assumed that the reader is familiar with Bernardos, Slavianoff and Kjellberg and that he thus knows the basic principles of arc welding. In a later article commercial applications of arc welding will be discussed and certain data will be given on welding practice.

In order to visualize present progress, the fundamental types of arcs in use to-day will be taken up, and the types of apparatus used to supply the electric energy will be discussed briefly in an endeavor to bring out the practical bearing of the various characteristics of welding operations.

Characteristics of Arc Types

There are four fundamental types of arcs in use, namely:

1. Constant potential applied to the arc and the fixed resistance in series therewith.
2. Variable potential applied to the arc, rising with falling current and falling with rising current.
3. Constant current.
4. Alternating current with reactive control.

Constant Potential.—This system is the oldest and is the only direct-current system which permits the connection of more than one arc in multiple on the same circuit. The voltage of the line ranges from 60 to 80, while the voltage of the metallic arc varies from 18 to 22 under average conditions of proper use; therefore from 40 volts to 60 volts must be absorbed in resistance. The ballast resistance limits the rise in current at the start and steadies the arc by varying the voltage across it so as to counteract changes in current.

In Fig. 1 is shown the volt-ampere characteristic of such a system, assuming values in wide practical use, namely, 150 amp. at 20 volts and $\frac{5}{32}$-in. (4-mm.) mild steel electrode. In practice the arc may vary, depending upon the operator, from 15 volts to 45 volts while welding, and when the arc is broken it will rise to a value that depends upon the voltage and inductance of the circuit. The temperature curve shown in Fig. 1 is obtained by dividing the power dissipated in the arc by the rate at which the metal is melted at the current value in question. This latter value is taken from observed data and is expressed in pounds per hour. Therefore the unit is kilowatts per pound per hour.

The current regulation of this system is excellent when operated by a skilled welder. By this is meant that the arc is steady and the current free from violent momentary fluctuations due to rapid variation in the counter-emf. of the arc. Furthermore, with this system the operator can learn to vary the heat over a considerable range by holding a longer or shorter arc; that is one of the principal reasons why the constant-potential system gives such erratic results in practice. A skilled operator uses the heat-varying feature to adapt the arc to the exact requirements of the weld from one instant to the next, while a less skilled operator may cause considerable variations in the heat without reference to the requirements of the work.

Variable Potential.—The variable-potential system is more difficult to generalize, because the characteristic depends entirely upon the design of the generator. In Fig. 2 is given the characteristic of one of the best known variable-voltage machines on the market. The variable-voltage generator has a drooping characteristic, and its normal operating current can be varied over a limited range. A reactor or stabilizer is usually employed to prevent constant surging of the current and emf. of the arc. Some machines possess enough internal reactance to stabilize the arc without the use of any external device.

The characteristics shown in Fig. 2 do not hold for the heat rise when the arc is broken, as in that event the current persists with increasing emf. until the energy stored in the inductance of the circuit, whether it be in the machine itself or in an external reactance, has been dissipated in the arc.

In this arc it is seen that the greatest stability of heat is obtained with a relatively long arc, and though the current varies more with the length of the arc than in the constant-potential system, the heat varies less, provided always the arc is not too short. There are some who do not advocate long arcs on account of the fact that the metal is unnecessarily exposed to the air, which is supposed to cause oxidization. The variable-potential arc with reactance in series is easier to hold than the constant-potential arc because of the relative constancy of the heating effect with a comparatively long arc. Unless the operator exercises due care to maintain a short arc at all times, however, there is a tendency to porous metal.

Constant Current.—This system is applicable to single arcs and to arcs in series. The characteristics are shown in Fig. 3. Comparison with Figs. 1 and 2 reveals the fact that the constant-current arc suffers a greater change in temperature of the metal with increase in length than either of the others. As far as decrease in length is concerned, the energy per pound of metal is practically the same in all systems. However, the increase in current and the corresponding increase in flow of metal in the variable-potential and constant-potential arcs make it harder to hold a short arc than with the constant-current system.

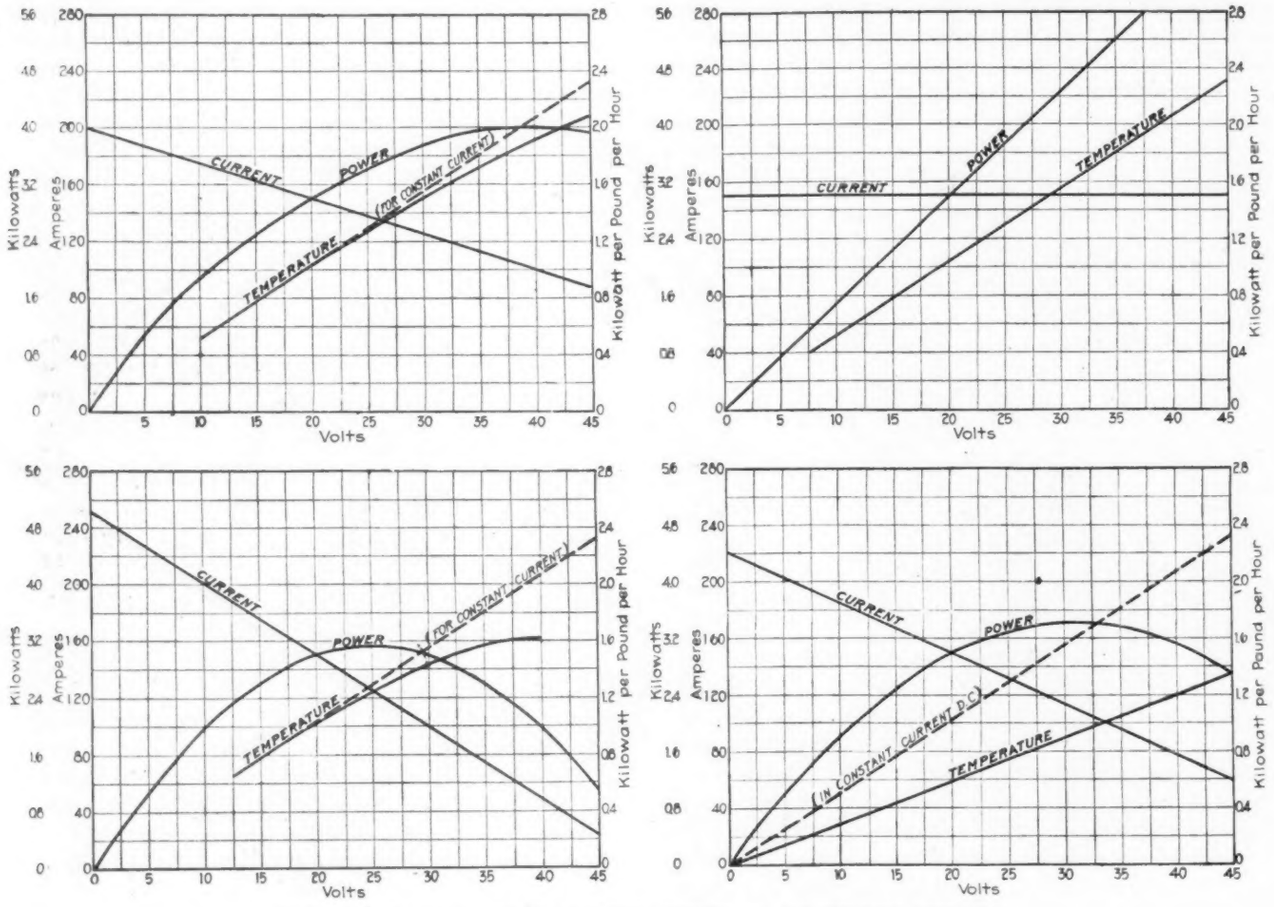
The distinctive characteristic of the constant-current system is the uniform flow of metal, which in itself greatly reduces the skill required to hold a short arc, and since the constant-current system, to be successful, requires a short arc this may be said to be a fortunate coincidence.

The author has devised a shunting control which permits the volt-ampere characteristic of the constant-current arc to be changed at will. By means of a shunt, the current line can be rotated in a clockwise direction about the normal point as a center, and by the use of a resistance in series with the arc and included by the shunt, a line of given slope can be raised or lowered to any desired point below the normal line current. In other words, the slope of the current characteristic is determined by the resistance of the shunt, while the percentage shunted from the main line is determined by the resistance in series with the arc. If we assume a 200-amp. constant line current and shunt the arc with 0.4 ohm resistance, we obtain exactly the same volt-ampere characteristic as in Fig. 1, and by varying the value of this shunt we can obtain any characteristic between the constant potential of Fig. 1 and the constant current of Fig. 3.

It so happens that the maximum percentage that can be shunted without seriously affecting the stability of the arc is that which corresponds to the volt-ampere characteristic of an arc fed from an 80-volt constant-potential circuit. However, as was mentioned before, the percentage of shunting can be increased to any desired degree by using the series-parallel shunt, as shown in Fig. 5. The series portion acts in a way which stabilizes the arc.

Alternating Current. — The alternating-current arc volt-ampere characteristic is shown in Fig. 4. On account of the alternations of the current it is impossible to draw a long arc, so that a short arc in necessary, and since a short arc with this characteristic is more sensitive to slight variations than a long one, the alternating-current arc is harder to hold than the same type of direct-current arc. The use of coated electrodes greatly assists in holding an alternating-current arc by retaining the hot vapors more readily than bare electrode does. Therefore, where the alternating-current arc is used the coated electrode should be employed if best results are to be expected.

The characteristics in Fig. 4 cannot be compared directly with those of the direct-current arcs because the melting rate of the alternating-current arc operated with coated electrode is much higher than the direct-current arc with bare electrode. First of all, the energy released on the electrode side of the arc is more, and then, on account of the insulating quality of the coating, it takes less energy to produce the temperature. From the curve it is seen that the characteristic of this arc lies between the variable-potential arc which is shown in Fig. 2 and the constant-potential arc which is shown in Fig. 1.



FIGS. 1, 2, 3 AND 4—CHARACTERISTIC CURVES OF ARC-WELDING SYSTEMS

Arc current and power are plotted against voltage at the arc. The arc temperature being proportional to the kilowatts per pound of electrode melted per hour is expressed in this unit. The top set of curves refer to constant-potential and constant-current systems respectively, while the bottom apply to variable-voltage and alternating-current systems.

There are seven fundamental types of supply systems in use for arc welding, namely:

1. Constant-potential generator, 60 volts to 80 volts, for use with fixed ballast resistance.

2. Constant-potential generator, 35 volts to 45 volts, flat compound, for use with automatically regulated ballast resistance.

3. Constant-potential two-voltage generator for use on three-wire system with fixed ballast resistances.

4. Differentially wound, separately excited generator, designed with drooping characteristic to limit current on short circuit and limit emf. on open circuit.

5. Differentially wound, separately excited generator operated with its motor as a balancer from 125-volt circuit.

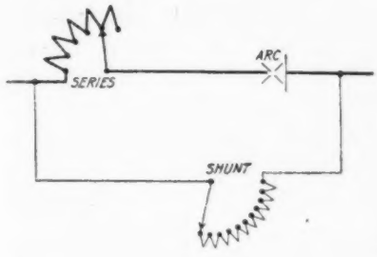
6. Constant-current generator.

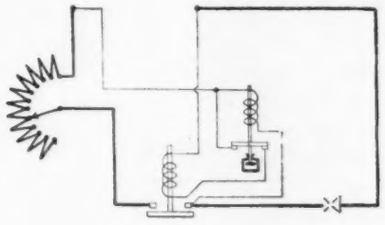
7. Alternating-current transformer designed with large leakage reactance to produce a drooping characteristic similar to that of the differential wound, separately excited generator.

Constant-Potential Generator, 60 to 80 Volts.—This type of welding supply is so well known that little need be said concerning it. Sixty volts is the practical low limit at which regulation can be obtained. Eighty volts is used more often than 60 volts, however, because the regulating characteristics are so much better.

Special control apparatus is used with this type of generator by some manufacturers to limit the duration of the initial rush of current when starting and also when the electrode sticks to the work. The wiring diagram of a typical system of this kind is shown in Fig. 6. Still another system uses a higher resistance in series with the arc at the start and then cuts out part of it automatically as soon as the arc is started. One of the oldest systems employs a contactor operated by the current through the arc to insert a resistor in place of the arc each time the arc goes out of circuit, thus maintaining a constant load on the generator. This, of course, is extremely wasteful of energy and requires a generator of higher rating than otherwise need be used.

The chief objection to the constant-potential high-voltage system is the loss in ballast resistance of from two to three times as much energy as is actually required for welding. On the other hand, it is a simple rough-and-ready plant that requires considerable welding skill but no electrical knowledge to operate.





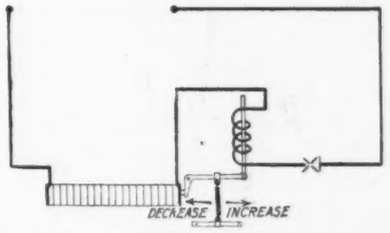
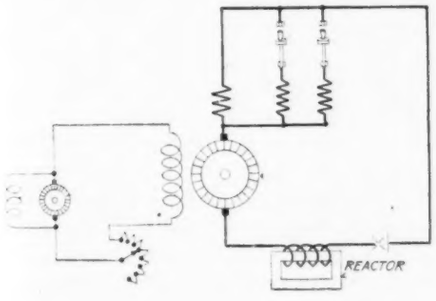


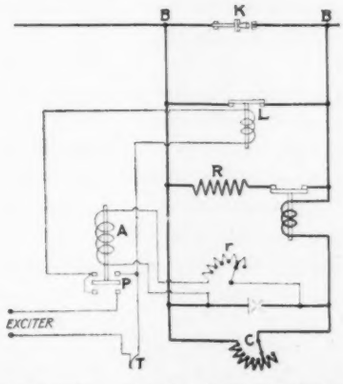
FIG. 5—SERIES-PARALLEL CONTROL CIRCUIT. FIG. 6—CONTROL WIRING WITH CONSTANT-VOLTAGE GENERATOR. FIG. 7—SCHEME FOR GETTING CONSTANT CURRENT WITH CONSTANT-VOLTAGE GENERATOR

Constant-Potential Generator, 35 to 45 Volts.—This system employs a standard flat compound generator to feed a special constant-current controller. The wiring diagram is shown in Fig. 7. The carbon pile and the solenoid that operates it are in series with the arc, so that the current through the arc is controlled by the automatic variation of the resistance of the carbon pile, in response to the pull of the solenoid. The pull of the solenoid is balanced in turn by a spring acting from a leverage, and the current adjustment is made by changing this leverage. A pilot motor that may be controlled by a switch from the welding tool handle regulates the leverage, so that the operator can change his current adjustment at will while welding,

In this system the power lost in the line and in the automatic resistor is reduced to from three-quarters to one and a quarter times the energy actually required for welding, which is a great saving over the constant-potential generator of higher voltage. This system also has the advantage of constant current through the arc, and when the generator is wound for 35 volts it limits the length of the arc sufficiently to give a very favorable break. But when the generator voltage is greater than 35 this advantage does not exist.

The range of current adjustment on a given control





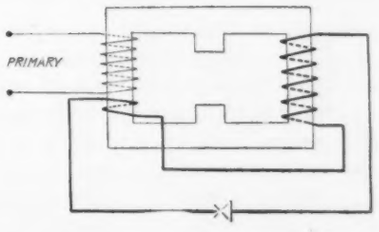


FIG. 8—DIFFERENTIALLY WOUND GENERATOR WITH REACTOR. FIG. 9—TYPICAL ARC CONTROLLER FOR CONSTANT-CURRENT SYSTEM. FIG. 10—HIGH-REACTANCE CONSTANT-CURRENT TRANSFORMER

panel, by means of leverage, is from approximately 50 per cent up to the maximum normal rating of the carbon pile. However, control panels designed for any current value within the range of the supply circuit can be used simultaneously on the same line. In order to operate the automatic resistor, a drop of at least 5 volts must be available, therefore the line drop must be kept down to less than 5 volts when the supply is 35 volts. This means that the work must be carried on near the generator, because of the cost of copper.

The low-voltage, constant-potential system with the automatic constant-current regulating control panels, involving considerable special apparatus, requires intelligent care by an electrician if the advantages of the system are to be realized. When the remote-control feature is eliminated, however, and the adjustments put in the hands of a competent man, more uniform results can be obtained with comparatively inexperienced operators than with other constant-potential systems.

The author does not approve of the feature that permits the operator to vary the current at will except where expert operators are concerned. It is this very feature that should be avoided in improving upon the constant-potential arc. On the other hand, this feature is valuable in repair work that is handled by highly skilled operators, as it enables the operator to adjust the current to meet the exact needs of the work without stopping the arc.

Constant-Potential Two-Voltage System.—One manufacturer has put on the market a three-wire system that furnishes a high emf. through a comparatively high ballast resistor to start the arc, and once the arc is started and the current reduced to a predetermined value, the arc is automatically transferred to a lower voltage line with a comparatively low ballast resistor. The regulation of the arc on the low-potential system is naturally much more sensitive than on the high emf. system. The only object of changing from high to low is to accomplish a saving in energy once the arc has been established, the regulation being left to the steadiness of the welder's hand. Incidentally, this system limits the length of the arc, on account of its instability and also on account of the low voltage.

Differentially Wound Generator.—This type of machine is marketed under various names, such as "variable voltage," "constant current" and "constant energy." "Variable voltage" is correct. "Constant current" is absolutely a misnomer, as a glance at Fig. 2 will reveal. Constant energy is approximately true over a very limited range. Every system is a constant-current and also a constant-energy system when the operator holds a perfectly steady arc, otherwise there is no constant-energy system on the market. Constant current can be obtained by a properly designed generator, but constant emf. at the arc can be obtained only by a steady hand, although a constant current through the arc assists the operator in holding a constant voltage.

In Fig. 8 is shown a typical wiring diagram of the variable potential system, using a reactor or stabilizer in series with the arc. The generator is differentially wound and taps are brought out from the series winding which carry the arc current, or the series winding may be shunted as indicated in Fig. 8. This field is opposed by that produced by a separately excited field. The normal welding current can be adjusted from about 40 per cent to its maximum value by varying the differential turns and the separate excitation. The machine is limited to use with one arc. Its characteristics were described in connection with Fig. 2. It is easily portable and simple to operate, therefore well adapted to many classes of work that do not require the finest degree of control. The energy loss in the welding circuit is extremely small, as no ballast resistance other than the reactor coil is required.

The chief disadvantages of this machine are the very considerable change in the flow of metal that takes place with change in the length of the arc and also the very large energy discharge that occurs each time the arc is broken when changing welding electrodes. In some kinds of work these characteristics are not objectionable. There are cases, however, where they cannot be tolerated.

Balancer.—This system, as far as welding characteristics are concerned, is practically the same as the variable-potential generator just described, and the description need not be repeated. The machines that have

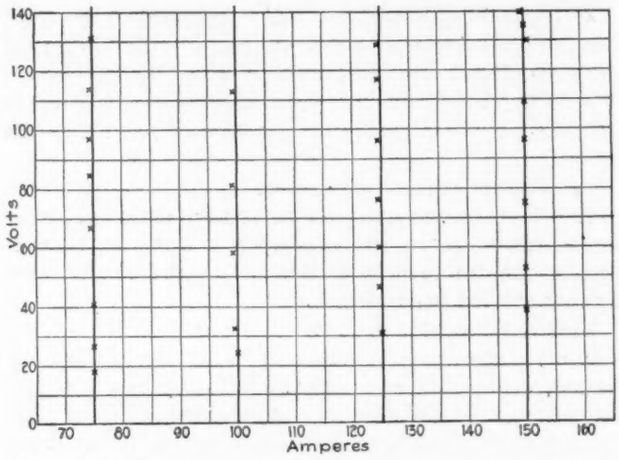


FIG. 11—TEST CURVES FOR CONSTANT-CURRENT GENERATOR WITH AUTOMATIC EXCITER

been put on the market are more sensitive as far as regulation is concerned than the straight single-arc machines and therefore require more skill to hold the arc unless the open-circuit voltage is set at 65 or higher. It has the advantage of saving enough material, as compared with the straight single-arc machine, where a sufficiently large installation is involved, to pay for the 125-volt generator required to operate the balancer.

Constant-Current Generator.—There are two types of constant-current generators that have been used for welding purposes, namely, (1) Rosenberg generator, (2) separately excited shunt generator with automatically regulated field current.

The Rosenberg generator has been used almost exclusively in Europe. It is a very heavy and expensive machine for its output and therefore has not been taken up extensively in this country. There are two types of regulated field machines in use, namely, (1) field current regulated by automatic resistor, (2) field current regulated by automatic exciter. Both these machines are employed in systems covered by patents issued to the writer. The first is used for one-arc installations, and the second for from one to ten arcs in series. The first provides approximately constant-current regulation over a limited range of current adjust-

ment (40 per cent to maximum), while the latter furnishes a practically perfect regulation over the entire range of the machine for all currents and voltages. Fig. 11 shows the results of an actual test of the latter system.

Connection of arcs in series requires that each arc on the same circuit be used on a separate piece of work and that the main circuit be kept closed at all times. This excludes the series system from ship welding and much of railroad shop welding. The natural field for the series or closed-circuit system is in manufacturing or production welding, where large numbers of the same type of welds are to be made.

A wiring diagram of a typical arc controller for insertion into a constant-current line is shown in Fig. 9. The controller is connected in series in the line at *BB*, and the knife switch *K* cuts out the controller by short-circuiting it. With *K* open and no welding going on, the contactors *S* and *L* are closed and pilot relay *P* is open. The path of the current is through the short circuit closed by contactor *L*. Preparatory to welding, the operator presses the trigger *T* in his welding handle. This excites coil *L* and opens the short circuit, leaving the resistor *R* across the terminals of the controller. The drop through *R* establishes a starting emf. across the terminals of the arc, and by varying *R* this starting voltage can be adjusted to any desired value. The arc is struck in the usual way and the current through *S* opens the contactor, dropping the resistor *R* out of circuit. The operator can then proceed with the arc until the voltage of the arc is drawn out to such a value that the current through coil *A* lifts *P*, cutting off coil *L* and short-circuiting the arc. The limited arc voltage that will automatically trip out the arc is set by adjusting rheostat *r*. It will be noted that the arc can be tripped out at any time without lengthening it simply by releasing the trigger *T*. If less than full line current is required, the excess is shunted around the arc through the rheostat *C*.

This type of control is expressly adapted to production work with ordinary labor, because it enables the foreman or expert to determine or adjust the current, length of arc and the regulation characteristic of a given panel, and the welder cannot operate it in any way except as set. There are a number of special types of controllers used on this closed-circuit system, but the diagram in Fig. 9 gives the basic principles involved in all.

Welding Transformer

Alternating current with ballast resistance has been used in arc welding for a number of years. With bare electrodes there are some obstacles, because it is difficult to start an arc on cold metal, although once the metal is heated up the arc works fairly well. With the covered electrode the arc is easily started and held from such circuits.

Recently special welding transformers designed with large leakage reactance have been placed on the market. The general scheme of the reactive method of control is contained in the diagram of Fig. 10. The primary winding is connected to the distribution line. The major portion of the secondary winding or welding circuit is wound on a separate leg of the magnetic circuit, and a smaller portion on the same leg with the primary, to give a fixed maximum voltage on short-circuit. Excessive current is prevented by leakage across the magnetic shunt between the primary and the secondary. As current in the welding circuit increases, part of the magnetism is forced across the air gap, and thus the voltage decreases until the balance is struck.

The welding transformer uses no ballast resistance; therefore its energy efficiency is high, but on account of its high leakage reactance its power factor is low. The system is chiefly important on account of its low first cost, and since its low power factor means excessive primary capacity (line copper, transformers, generators, etc.) its field of commercial application is naturally limited to small installations where the excess primary capacity already exists. If this excess capacity has to be provided, the alternating-current system becomes the most expensive of all.

As far as welding results are concerned, it does not differ materially from the various standard direct-current systems on the market. However, on account of greater sensitivity of the arc, and also on account of the fact that covered electrodes are practically necessary, it is more expensive when operated at all continuously than some of the other systems.

DISPOSING OF GOVERNMENT CONSTRUCTION MATERIAL

Large Supplies on Hand Demand a Method for Their Disposition Which Will Not Interfere with Markets in This Country

The Western Society of Engineers, Chicago, has been asked to approve and adopt a plan for the use of the enormous quantities of construction supplies on hand to aid in the physical restoration of France. The chief points of the plan are:

1. That the United States shall propose to France to collect all construction material now in warehouses and yards in this country and in France to be turned over to France, and that the delivery of this material be expedited by every possible means.

2. That the value of this material shall be considered a part of the cost of the war and shall be charged to Germany.

3. That a part of the construction division, Quartermaster's Corps of the United States Army shall be sent to France to work with French engineers in planning the erection of this material into the needed buildings in the devastated area.

In submitting this plan, John V. Shaffer pointed out that one-sixth of the area of France has been entirely devastated, that 350,000 homes and one-sixth of the pig-iron industry of France have been entirely ruined, and that one-fifteenth of the French people are gone at this time when speedy rehabilitation is most desirable. Aside from the humanitarian reasons why the United States should carry out this program, Mr. Shaffer stated there are many economic reasons why the plan is desirable. The principal among these are that such disposal of the material would tend to stabilize American markets, would assist in developing our foreign trade, and would create a demand for additional material since that on hand is insufficient for carrying on the complete physical restoration of France.

The Advantages of Uniform Motor Design*

Opportunities That Are Afforded for Enlarged and More Profitable Business Through the Improvement of Efficiency and Economy of Electric Motor Drive from the Standpoint of Operation, Maintenance and Repairs

BY JAMES BURKE
President Burke Electric Company, Erie, Pa.

THE purpose of this paper is to start a constructive discussion on the advantages of a uniform motor design. It is a privilege to be able to tell you about some work accomplished in this direction in another land, some of which may be applicable to conditions existing in this country.

The movement was started by the efficiency committee of a large manufacturing company which had wisely adopted electric motor drive throughout its various plants and was constantly buying new motors in connection with the rapid growth of its plant. Naturally all the manufacturers of electric motors were endeavoring to get their share of this desirable business, and each motor manufacturer presented the good points of his motors by calling attention to how they differed from the equivalent in motors of their competitors. One told about his practice in using more commutator bars than the other. Another told about using larger shafts than the others. Another told about furnishing larger pulleys than his competitors. One brought out strongly the relatively long distance between bolt holes on the feet in the direction parallel to the shaft. Another called attention to a similar dimension but at right angles to the shaft. All of the motor manufacturers were unanimous in claiming that each one was entitled to the entire business or to at least a fair share of it. The efficiency committee of the purchaser studied over the matter, which had been well presented to them by the motor manufacturers, and also carefully considered the practical experience which the purchaser had undergone with the motors already installed, and then wrote the following letter to all of the manufacturers of electric motors:

Gentlemen: As large purchasers of motors we feel that you ought to know our opinion of your product and the considerations which influence our decision in purchasing.

Your representative was under the impression that your prices should be the determining factor, and we want you to know that this is really of secondary importance. We are willing to pay much higher prices if the increased investment is justified by the economies in the operation of our plant as a whole.

You all manufacture good motors, and each one of you has certain good points, but your motors are all so different from each other and your good points differ so much that if in any one of our plants we use motors of several different makes we have as much confusion as if our foremen were of a variety of nationalities each speaking his own language and all having very limited vocabulary in common. We think that individually your motors are fine fellows, but collectively you are very poor for team work.

In the operation of all of our machinery we necessarily have repairs to make, and we feel that a reasonable amount of repairs on electric motors is to be expected. We maintain an efficient repair department and carry spare parts and also spare motors. If a motor breaks down, we replace it with one of our spare motors, and repairs are made on the defective motor in our repair shop, where we try to practice some of the economies employed in regular manufacture.

It is naturally embarrassing and expensive to find that if the spare motor happens to be of another make we have to change the foundation on which the motor is placed or spend some money on temporary structure, all because the dimensions and location of the feet and holding-down bolts are arbitrarily determined and the different motor manufacturers are so arbitrary that they intentionally make them different. We have been told that there are inherent differences in electrical design which necessitate these differences in location of feet, etc., but we submit for your consideration that it would be possible for us to standardize certain plates on which we could attach motors as we purchased them, and these plates, which would become sub-bases, would make the motors interchangeable from that standpoint. You can doubtless save the expense of such plates or sub-bases by making them integral with the motor, which of course means simply adopting some standard dimension of feet and bolt-hole location and bolts. We would rather pay you what the uniform sub-bases would cost us than to have the trouble of making these ourselves, and as your only expense would be in making some changes in patterns and jigs we submit that this investment would be warranted by your increased receipts.

SHAFTS AND PULLEYS

After taking care of our foundation problem and getting the spare motor into operation, it is very embarrassing to find that the driven machine is operating at a different speed due to the pulley on the spare motor being of different diameter from the one previously operating at that location. Our first thought is to take the pulley off the defective motor and put it on the spare motor, but we find that between these two motors of the same horsepower and speed there is a difference in the diameter of shaft of $\frac{1}{8}$-in., and therefore we have either to bush or bore out the pulley. We have been told by some motor manufacturers that their shafts are calculated by the best kind of mathematics that money can buy and that they cannot make any changes. Of course, one remedy would be for us to buy our motors without pulleys and adopt our own standard of shaft diameters for each horsepower rating of motor and buy our own pulleys accordingly. We know that no manufacturer of motors is supplying motors with shafts so small that they will break in practice, and therefore we could adopt as our standard the diameter of shaft of that motor which has the smallest diameter and turn down all shafts of other makes of motors of this horsepower and speed to this same dimension. However, we would rather pay the motor manufacturer to do this for us and save us the trouble.

BOLTS, NUTS AND SCREWS

A complaint was recently made that our repair department spoiled the appearance of bolt heads and nuts by using monkeywrenches on them, and the obvious remedy was to use standard wrenches. However, it was found that there was no uniformity in the dimensions of nuts and bolt heads and that a large variety of wrenches would be required for each size of bolt or nut. Even when it was attempted to follow the national standard, we found that some manufacturers used machine-finished nuts, while others used hot-finished nuts and bolt heads, and still others entirely rough, and that there was enough variation between them to make the standardization of wrenches impracticable.

Of course, sometimes a cup screw gets damaged or

*Address before Electric Power Club at Cleveland, Ohio, Jan. 15, 1919.

broken, and it is our practice to carry a variety of cap screws, bolts, nuts, etc., in stock for repair purposes. One of our recent experiences was that a ½-in. cap screw was broken in taking it out of a motor, and although we had some of this size in our spare-part collection which we carry in stock, we found that it was of no avail because the broken one had twelve threads to the inch and our spare stock had thirteen threads to the inch. This led to an investigation of why we had purchased a ½-in. cap screw with thirteen threads to the inch, and we found this was selected from a certain motor which was under repair at the time the selection was made. Further investigation showed that some motor manufacturers use twelve threads per inch and others thirteen. We called this to the attention of a salesman from one motor manufacturer, but he thought that a difference of one thread was not worth talking about. He may be right, but we feel that it is at least worth paying for, and we will pay a little more for motors that are practically standardized in this respect as well as theoretically. We are aware of the fact that for the ½-in. screw both twelve and thirteen threads to the inch are national standards, but why don't the motor manufacturers adopt one of them and forget the other?

WIRE

Some years ago motor manufacturers used special sizes of wire, and when we had a breakdown requiring rewinding we experienced a long delay in getting this special wire from that particular motor manufacturer. Of course, our requirement was too small in quantity to get any of the wire manufacturers to make it for us. In a good many emergencies we could not wait, and so we used the nearest standard size of wire that would fit, and although at first we did this with fear and trembling, as we had heard so much of the exact calculations made by motor manufacturers in determining the size of wires, nevertheless we did not encounter any serious results. We are happy to find that practically all of the motor manufacturers now pretty generally use the standard wire gages.

Occasionally we find square wire used in armatures, and while we realize that this is done to obtain a greater output from the same size of machine, we would rather pay more for a machine wound with round wire. We would thereby avoid carrying in stock square wire for repair purposes, and in addition to this our repair department tells us that it is more difficult to repair a machine with square wire than with round as the sharp corners result in damage to the insulation. In several cases we have substituted round wire for the square in repair work. We do not claim that our repair men are engineers or that they know anything about the mathematics of electricity, but we think that if your engineers knew some of the things that our practical repair men do motors would be better from our standpoint of operation and maintenance. Sometimes we run across motors with armatures wound with rectangular copper of some odd dimension which cannot be purchased in the open market, and quite often the manufacturer of that motor is out of the stock of that special size of copper when we need it for repairs. We may continue to buy motors from that manufacturer, but we discontinue that particular size from him.

COMMUTATORS AND BEARINGS

We carry some spare commutators in stock for repair purposes, but we naturally cannot carry all sizes of all motor manufacturers. If commutators could be standardized, we would be in much better shape for making our repairs, and the records of some makes of motors as to the number of days that they are out of service when repairs are necessary would be very much improved. We fully appreciate that commutators are expected to wear out in time, and the fact of a necessary replacement of commutator only becomes conspicuous with us on account of the delay incidental thereto.

Sometimes we have to put in new bearings due to the natural wear in use or occasionally to neglect in oiling. This means that we have to carry in stock reserve bearings for every size of motor multiplied by every make of motor. We have no criticisms of the bearings in any of the makes of motors which we are using, and would be satisfied to have any one of them adopted as the standard, and our repair problem would be much simplified thereby.

The variety of sizes of brushes is a serious complication and necessitates the carrying in our repair stock of about thirty-five different sizes of brushes. As we have to buy these in fair quantities, you will realize the large amount of money which we have to keep tied up in this item alone and also the care necessary to be sure that we do not run out of any one of these sizes. We do not understand why, for a motor of any specified horsepower and speed, the same size of brushes could not be used by the various motor manufacturers.

Recently we were in the market for a motor and wanted to place the order with a motor manufacturer who we had heard was furnishing very good motors, and wished to give that concern an opportunity, but it was pointed out that we had in use fifteen motors of this horsepower and speed of another make, and also had two spare armatures, and that we would be safer to get another motor of the make in use on account of the advantage of the spare armatures. Of course, this condition could be met by buying an extra armature with the new motor of the make which we did not have in use, but we felt the expense of this armature was not warranted. The thought occurred to us that possibly the armatures might be interchangeable between the motors which we had in use and the one which we desired to purchase, and so we asked for information on certain dimensions of the armature and compared same with the spare armatures on hand. We found that one had an armature core of 18¼-in. diameter, with 8 in of punching assembly, and the other had 18½-in. diameter with 7¾ in. punching assembly. One had sixty armature slots and the other had sixty-four. One had 120 commutator bars and the other had 128. The length of the commutator on one was ½ in. longer than on the other. Of course, we appreciate that there must be good scientific reasons for these slight differences, but we felt that the differences were so slight, although sufficient to make interchangeability impossible, that the adoption of some compromise between these two might not have resulted in a very bad motor.

In conclusion, we wish to say that, although you may find our ideas theoretically and scientifically wrong, we feel that from a practical standpoint they are right, and are willing to back them up by paying more for motors which embody these features of interchangeability. Our idea of the magnitude of this problem is best expressed by what we would be willing to pay for these advantages. We feel that, for any given size and speed of motor, if five motor manufacturers are using a uniform and interchangeable design, we would be willing to pay to each of these companies 10 per cent more a motor than to the companies that are not following the uniform design. Further, if any five companies adopted some plan of uniformity and interchangeability in their complete line of motors, we would feel strongly inclined to place our entire business with those companies provided they could supply our requirements.

Yours for progress, EFFICIENCY COMMITTEE.

The motor manufacturers were righteously indignant at the presumption of this purchaser in trying to tell them how to build motors. Some of them replied, and a few samples of these letters are given. One of them is as follows:

If we all manufactured motors of the same dimensions and practically the same design, the initiative of our designing engineers would be killed and salesmanship would cease because our salesmen would have no talking points on the features of our motors compared with those of our competitors.

To this the sender received the following reply:

All of the steel mills furnish channel, angle and other shapes of uniform design and dimensions and weights, and notwithstanding this the demand for steel engineers is greater than the supply. Steel manufacturers probably make nearly as large percentage profit as motor manufacturers, and their salesmen usually have something to talk about.

Another motor manufacturer wrote as follows:

Even if uniform design was adopted, the motors and parts would not be interchangeable on account of variations in manufacture.

To this the following reply was sent:

There are some companies which furnish new commutators to fit any of the standard makes of motors, and we know from experience that they do fit. Cannot each motor manufacturer do equally accurate work compared with these concerns that make spare commutators? We know that five manufacturers of ball bearings make the ball bearings interchangeable, so that if we have a motor with one style of ball bearings in it, any of the other four makes will fit. Why cannot motor manufacturers who manufacture plain sleeve bearings, which are much simpler than ball bearings, maintain a quality of workmanship which will keep them interchangeable? The problem is much simplified by adopting some standard make of gages. We know of one large motor manufacturer operating three manufacturing plants on the same kind of motors of uniform design, which they claim are interchangeable. If these three plants were owned by separate interests instead of one interest, the problem should not be changed. All you need is coöperation.

Another manufacturer wrote as follows:

I have the honor to be president and financial backer of our company. I started my electrical career by investing a small amount in a new company which was going to manufacture motors and put all the other motor manufacturers out of business. I am permitted to make an additional contribution every year, and after doing so our books just balance without any profit or loss to worry over. Your kind words look good to me, and I am going to invite the president and financial backers of a number of the motor manufacturers to a conference on this subject. I feel better already.

The convention of the motor-manufacturing presidents was more in the nature of a court of inquiry, and the designing engineers of various companies were called before them for opinions and explanations. Their opinion varied to some extent, but in general the conclusions were that from an engineering standpoint a uniform motor design was morally wrong, with a minority opinion that it was morally rotten; that the consumer and purchaser of motors would be getting more than he was entitled to; that the manufacturer of electric motors would be degraded into an ordinary money-making business without a soul and without artistic temperament.

OPPORTUNITIES FOR STANDARDIZATION

Finally one of the presidents advanced the idea that all the talent in the designing of electric motors was progressive and energetic but was misdirected, and that the mistake had been made of expecting engineers to organize the business instead of conducting engineering work along lines laid down by the organization. The ultimate outcome was the formation of an organization known as "The Electrical Manufacturers' Institute." This institute has undertaken not only the problem of uniform motor design but many other problems that will make the manufacture of electric motors a more profitable and happier business.

The institute has laid down the fundamental principles that the best way to sell more motors is to create a bigger demand for them and that everything which will improve the efficiency and economy of electric motor drive from the standpoint of operation, maintenance and repairs is going to create a correspondingly greater demand; that the real competition which motor manufacturers have to meet is not with other makes of motors but other forms of power transmission; that many of the best engineers are wasting their energies in designing different kinds of motors for each motor manufacturer, whereas a small group could do the designing for all of the manufacturers and the rest of them would be available for the broad and better field of application engineering.

Some of the work already accomplished by the Electrical Manufacturers' Institute may be worthy of notice, all committees being under salary:

It has formed a "central bureau of design" employing at substantial salaries designing engineers selected from the various manufacturing companies.

It has formed a "central testing bureau." All new designs of motors are tested in this bureau, and the characteristic information, such as on efficiencies, power factor and all other features of performance, is obtained and all experimental testing conducted in this bureau. This not only saves expense to manufacturers but is considered more authoritative as it is non-competitive.

It has formed a "committee on awards for improvements." This committee considers all suggestions and submits and discusses them with the central bureau of design and other committees, and if the suggestions are adopted, makes appropriate award. This takes the form sometimes of a recommendation of increase in salary, sometimes of a percentage of the saving made and sometimes of an award in cash. As an example of this committee's work, a suggestion was received from a young engineer that the terminal cables on motors were unnecessarily long and would be more convenient if made shorter. Incidentally he pointed out that an average of 3 in. of cable could be saved on each lead. The total saving to the motor industry amounted to an enormous amount, and this young engineer not only received a substantial increase in salary but a cash award amounting to about $5,000 in our money.

A committee on the purchase of material was formed which prepared specifications and gave advice to the purchasing agents of the various companies. Methods of making patterns were settled by this committee in coöperation with the various foundries. In many cases large quantities of castings were made at a few central points and distributed to the various manufacturers. The requirements for commutator bars and other special material were combined so that greater quantities could be made at a time with the resulting economy in cost.

A committee on preparation of bids was formed. This committee takes care of the preparation of all engineering information, which is submitted to a prospective purchaser in answer to his specifications and inquiries as the engineering information of all manufacturers using the uniform motor design, each manufacturer, of course, making his commercial bid separately. This committee plan was found necessary because engineering information or calculated and predicted test information varied so much between the different manufacturers, although they were all figuring on exactly the same design of motor.

One of the most interesting developments which have already taken place is the discovery that a great many of the formulas and constants which had been sacredly adhered to by designing engineering were entirely wrong. They were undoubtedly the best possible at

the time they were developed, but have been handed down from one author to another and copied from one book into another without taking advantage of new evidence which necessarily modified these conclusions.

A new committee has recently been formed to cover the work of making every electric motor manufacturer a repair station for all of the manufacturers who are using the uniform motor design. This will permit of great saving in time in repairing motors for those concerns which are not large enough to have their own repair departments in various cities.

Incidentally it is thought that with every motor manufacturer who is following the uniform motor design, concentrating on the quality of his interpretation of this design, the life of motors will be very much improved and that the word "guarantee" will go into the discard.

Another committee which the Electrical Manufacturers' Institute has formed is the "export committee." It rightfully claims to have advantages over the manufacturers of all other countries for foreign trade on account of the uniform motor design and interchangeability.

The member companies are extremely enthusiastic and believe that their business will be lifted from the field of drudgery, long hours and worry to that of the pleasure of living with enough work to keep one healthy.

Now, gentlemen, what can we do in the United States along these lines? The United States of America has played a most important part in terminating a world war that had no parallel in history. We have manufactured shells and guns and other munitions all over the country and all in accordance with uniform design and interchangeability. The precision on shell manufacture has been greater than is necessary in motor manufacture, and many of the electric motor manufacturers have manufactured shells of uniform design and dimensions and have made good. Can we not do likewise in this business of our choice?

I hear some one asking in what land all these things happened, and I find that I overlooked mentioning this in the beginning of this paper. It was in the Land of Dreams, but sometimes dreams come true.

GOVERNMENT DIRECTION IN FOREIGN EXPORT TRADE

Bureau of Foreign and Domestic Commerce Organized to Assist Those Seeking International Markets—Trade Commissioners Now in This Country

The possibilities of the application to industry of the organization created by Secretary William C. Redfield of the Department of Commerce is shown in the accompanying diagram. From reports of the various trade commissioners now returning to this country many feel that the work of the Department of Commerce should be of infinite value to American manufacturers who are seeking foreign markets.

Aside from the information shown on this chart there is being issued a monthly index on statistics pertaining to specific articles of import and export, as well as general information on markets for given products.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE
FOREIGN TRADE PROMOTION
RESEARCH
Foreign Tariffs
Information concerning foreign tariff and customs laws and regulations, commercial policies of foreign countries, foreign trade-marks and patent laws, embargoes and import prohibition, and foreign consular regulations.
Research
Supplies information on import and export statistics of all foreign countries, foreign sources of supply of raw materials, translating, and researches in all phases of foreign trade.
Statistics
Supplies information regarding import and export statistics of the trade of the United States with all countries. These statistics are furnished in tenday, monthly, quarterly and yearly periods.
Far East
Information regarding ports and transportation facilities, investment opportunities, mineral resources and their development, and the markets for cotton goods, wearing apparel, railway equipment, motor vehicles, shoes and leather, etc.
Latin America
Information concerning markets for American products, regulations for guidance of commercial travelers, trade condition in Latin America, specific openings for American exports, and concerns which might act as representatives of American exporters.
ADVICE AND INFORMATION
FIELD WORK
Correspondence
Furnishes American exporters information on markets in foreign countries, including advice on methods of packing, financing export shipments, sources of foreign credit data, lists of importers abroad, and names of domestic manufacturers.
Editorial
Makes available to the business public, through publications and indexes, information on commercial and industrial conditions in all parts of the world.
District Offices
Miniature bureaus at New York, Boston, Chicago, St. Louis, New Orleans, San Francisco and Seattle. Recognized centers for reliable information regarding domestic and foreign trade. Render special service to foreign buyers seeking goods in the United States, and adjusting trade differences.
Commercial Attaches
Located in the principal capitals of the world, furnish first-hand information and advice on banking, commercial, industrial and investment conditions abroad.
Special Agents
Technical trade investigators who study foreign markets for specific American commodities, also assist American manufacturers and exporters to establish satisfactory trade relations with particular foreign importers.
Trade Commissioners
Men with commercial and economic training who study general trade conditions abroad, with particular reference to increased sale of American products, supplying of raw materials necessary in American industries, etc.

WHAT SHOULD AMERICA DO TO AID RECONSTRUCTION?

Calmness, Patience and a Steady Look Ahead Will Carry Business Safely Through the Period of Uncertainty

BY ROBERT K. SHEPPARD
Sales Manager, Simplex Wire & Cable Company

CALMNESS, patience and a steady look ahead into the not-too-near future will carry American business safely through the complexities of these post-war days. True, the world cataclysm has brought forth a new Europe and Siberia, a rearranged Africa, a firmly welded British Empire, an awakened China, a thoroughly energized America. But the force and ultimate grip on human affairs of the law of supply and demand have not been weakened by our efforts to suspend for a brief period that law's penalties and compulsions.

For generations to come the peoples of Central Europe must pay, directly to some extent, indirectly to a far greater degree, the stupendous taxes inherited from the war and the war's aftermath of "restoration, restitution and reparation." In those lands the daily wage, the weekly salary and the selling prices of all commodities will rise until the people can pay those taxes and also can obtain all of life's necessaries and some luxuries. The industrial effectives of the Central Empires have been decimated on the fighting fronts, by disease and by starvation. Just now chaos reigns. Perhaps never again, certainly not until political stability obtains, can the potential economic strength of Germany's surviving toilers be concentrated and flung against us in the mass formation which was as characteristic of Germany's foreign trade before as of her military strategy during the war.

Let these factors in the commercial struggle give pause to those who croak their warnings about impending destructive competion from those lands. Let sound economics prove to us that the sooner the Huns are busied industrially the faster will their inevitably high production costs become apparent from the prices they will demand for their goods, now that the reservoirs of imperial subsidies have gone dry forever.

France must restore her industries in the north, and elsewhere reëquip her factories for peaceful pursuits, before she will be ready for her full commercial endeavor. Even then her historic export policy, specializing on those commodities which her people can make best, many of them the world's luxuries, is not likely to change. For those goods France can and will obtain good prices. She is not a commercial lizard that she should discard tried garments of quality and high value for the tawdry of the cut-throat and the pirate.

Italy still is poor. Her manufactures are not comprehensively diversified. We need fear her rivalry in only a few directions.

Great Britain remains. She is a stern competitor because she is aggressive and never wearies. Her products generally are good. Her costs will not now be much lower, if any, than our own. Moreover, she is now embarked on imperfectly charted political seas. Her labor unions may yet sway those "right little, tight little" isles whose policies affect so large a part of this earth. Do American business men suffer sleepless nights for fear that labor rule in Great Britain will reduce her already high production costs?

France, Italy, Great Britain, all are saddled with the legacies of war in so big a ratio to their national wealth that the slow processes and inevitable incompleteness of German reparation will leave them burdened with heavy taxes for many a decade.

WHAT OF THE UNITED STATES?

Now what of our land?

Millions of young Americans, the youth in performing their military and naval duties, the women in their manifold services to the nation and her fighting sons, have learned that hard work pays. Let our people now understand that truly a nation prospers only as its material, mental and spiritual productivity increases.

When men produce more per worker, obtaining for that increased production proper increase in pay, then the workers will truly prosper. The products to be bought are more abundant, never more but often less costly per unit. Moreover, the worker has more money with which to buy.

Conversely, when men get more pay per worker for the same old volume of production per worker, the cost of living is universally raised so that the recipients of the extra pay are not profited. The products to be bought are not more abundant but they are more costly per unit. Each worker divides his increase between other workers and has none left for himself.

With their eyes so widely opened surely those young Americans will perceive, so let them teach, that as an individual's hands and brain produce per day or per year more and still more of the tangibles or intangibles which others require, so his life becomes richer, influential and finally successful.

When such men rule our country, their guidance is bound to be beneficent. Conceiving that their day of power now is at hand, we may answer the question, "What then should America do?"

1. Swing back swiftly to private control of every business activity which has not been fostered by, or has not acquired, public grants of land, natural resources, franchises, subsidies or other special privileges.

2. Repeal federal and state inhibitions against private coöperation and combination by individuals, natural or corporate, and impose healthily restraining federal supervision of the acts of every such combination of individuals or coöperative organization.

3. Under rational governmental supervision, retain or reinstate private control of quasi-public activities, especially those in the pursuit of which productive labor has to be employed.

4. Retain completely under government management only those activities which are essential to the maintenance of local, national and international law, order and justice.

Water-Power Development on the Pacific Coast

Study of Economic and Financial Conditions Leads to Outline of Developments Approximating $50,000,000 Cost, and All of the Power Furnished Can Be Absorbed Easily Within Two Years After Development

BY MAJOR GEORGE F. SEVER, U. S. A. ENGINEERS

These extracts from a paper presented by Major Sever last month before the San Francisco Association of Members of the American Society of Civil Engineers follow his study and report for the War Industries Board. Upon the basis of the information that oil is likely to remain high, Major Sever pointed out that there has entered into the problem of electric power supply a new and serious factor which warrants an early and large development of hydroelectric power.

IN LAYING out a program for meeting the power deficiency it was necessary to consider what could be secured during one, two and three years. It was felt that the war might last at least until 1920, and consequently it was necessary to lay out a program which would provide for power to meet the present deficiency, the natural increase plus the power needed for additional war contracts and that amount which was deemed necessary to conserve fuel oil as used by the public utility steam plants. It is on the basis of this program that the developments which I will outline have been made.

In the first place it was desirable to secure developments which could be made inside of a year, then those that could be made available inside of two years, and further, those that might be brought in within three years, thus meeting the above-arranged program.

Six Great Power Companies

There are within the industrial districts of the central and northern part of the state six important power companies, known as the California-Oregon Power Company, the Northern California Power Company, the Pacific Gas & Electric Company, the Great Western Power Company, the Western States Gas & Electric Company and the Sierra & San Francisco Power Company.

There is no shortage of electric power, nor has there been any, on the system of the California-Oregon Power Company, and my investigations show that there was no shortage on the system of the Northern California Power Company. There has been a shortage of power on the systems of the Pacific Gas & Electric Company, the Great Western Power Company and the Sierra & San Francisco Power Company, and in my investigations I have paid particular attention to these three companies, as each of them has developments which can be easily and quickly made to meet the program that I have indicated should be followed. Each one of these companies has a fundamental development which is in use now for power supply purposes, and each one has a steam standby service which enables it to carry a portion of its load when there is trouble on the transmission lines from the hydroelectric supply. The steam stations also act as a means of regulating the voltage and for taking the short-time peaks on the systems.

After a careful inspection of the various developments, the author's recommendations as to the work that should be done on the Pacific Gas & Electric system are the raising of the dam at Fordyce Lake 21 ft. (6.4 m.) so as to add 11,800 acre-ft. (14,500,000 cu.m.) of storage, this water being spilled into Lake Spaulding and then put through the Spaulding, Drum, Halsey and Wise power stations, and later, in time, through a No. 2 station which is recommended to be built. The Fordyce dam is of the rock-filled type, with a wooden facing, and the 21-ft., (6.4-m.) increase in height is the most economical construction that can be secured. If it should be raised to a greater height, there would be required a largely increased expenditure which is not now warranted.

The second item is the raising of the Lake Spaulding dam 10 ft. (3 m.) so as to add 6423 acre-ft. (7,900,000 cu.m.) to the storage in this important reservoir. The additional water is intended to be passed through the Drum and other stations mentioned above, and also the No. 2 station, the construction of which is in contemplation. Besides these two increases in storage capacities, there is what is known as the "Bowman-Spaulding project," which will add a large storage capacity to the system, and the water would be spilled into Lake Spaulding. The building of a No. 2 station on the Bear River, with a capacity of 25,000 kw., will, together with the present stations and the additional storage, provide 233,000,000 additional kw.-hr. to the Pacific Gas & Electric Company's system. The cost of these improvements is approximately $7,200,000.

In addition to these hydro developments on the Pacific Gas & Electric Company's system, there will be installed in Station "A" in San Francisco and Station "C" in Oakland the full complement of boilers to make the electric generating apparatus fully available. The cost for these steam additions will be approximately $525,000. Heretofore the practice on the Pacific Coast has been to equip a steam station with only a sufficient number of boilers to operate generating machinery to give good regulation, to take a portion of the load in case of trouble on the transmission line and to handle the peaks during the so-called rush hours or periods. It is also used to build up load which can later be transferred *en bloc* to a hydro plant which has been under construction for some time.

Proposed Feather River Development

The next important addition to the power capacity is that of the Great Western Power Company in its proposed development of a 40,000-kw. station on the Feather River at Butte Valley. It is proposed to run a tunnel 11,800 ft. (3.6 km.) long from Lake Almanor into Butte Valley, and thence by another tunnel 10,400 ft. (3.2 km.) long to the point of drop into the Feather

River, dropping this water 1155 ft. (320 m.) into the power station in the bed of the canyon. This project will cost in the vicinity of $6,000,000 and will take about two to two and one-half years to construct.

The Sierra & San Francisco Power Company has its power station and reservoirs in and about the Stanislaus National Forest Reserve and on the Stanislaus River. This company is in a position to supply power at the earliest date. It has two reservoirs in operation, namely, the "Relief," 14,965 acre-ft. (18,400,000 cu.m.) and "Strawberry," 17,900 acre-ft. (22,000,000 cu.m.). It has in prospect another reservoir known as "Big Dam," 16,654 acre-ft. (20,400,000 cu.m.), which would spill its water into "Strawberry." At the present time water from the South Fork of the Stanislaus and "Strawberry" is running in what is known as the "Philadelphia Ditch," at the rate of 50 sec.-ft. (1.41 cu.m. per sec.), which spills from a height of 1860 ft. (567 m.) at Spring Gap into the Middle Fork of the Stanislaus River and is diverted at the Sand Bar dam into the present flume to the Stanislaus power station. It is proposed to put a power station at the foot of this present spillway near Baker's Crossing containing a 9000-kw. generator, and later, when the size of the ditch has been increased to accommodate 100 sec.-ft. (2.82 cu.m. per sec.), to add another 9000-kw. unit at this point, thus giving 18,000 kw. additional development. At the same time an increase in the size of the penstock at the Stanislaus power station will gain 7000 kw. which is now lost in friction head. This will make available the total capacity of 40,000 kw. at Stanislaus.

There is also contemplated in connection with the North Beach steam station of this company an increase in the boiler capacity so as to make the three 9000-kw. units available for full operation. The cost of these additions will approximate $2,000,000.

Besides the previous developments which I have definitely recommended on the basis of a war-time program, there are many other available power developments, some of which have been carefully considered by me, but I have not thought them worthy of recommendation on the basis of war-time service. Among these might be mentioned the projects on the Big Bend of the Pitt River of the Pacific Gas & Electric Company and the Northern California Power Company; the Fall River development, between Fall River and Pitt River, and also the various smaller projects on the Pitt River and its tributaries; the additional developments on the North Fork of the Feather River, owned by the Great Western Power Company; the first project in connection with the Hetch Hetchy water supply, which will take approximately three years to develop, and other smaller developments which can be secured on the Pacific Gas & Electric Company's system, and also the Western States Gas & Electric system in the central part of the state. There are developments contemplated by the Southern California Edison Company and the Southern Sierra Power Company, as well as by the San Joaquin Light & Power Corporation, and the city of Los Angeles contemplates the development of approximately 21,000 kw. in connection with its aqueduct.

Without considering the latter project, the total additions to the systems I have mentioned approximate a cost of $50,000,000, and so far as my investigations go I am convinced that all of this power can be easily absorbed within two years after development.

An entirely new project which was brought to my attention and which I have carefully investigated is now known as the Pitt River Power Company and is intended to develop power at two locations on the Lower Pitt River by the construction of two dams, each giving a first possible development of about 32,000 kw. Favorable recommendation was given to this project.

At the present time there exist between the companies in and about the bay district interconnections so that the companies can exchange power between their systems. An additional interconnection was found desirable between the Sierra & San Francisco Power Company and the Pacific Gas & Electric Company.

It is also extremely desirable for the companies to arrange for complete interconnection of the steam stations, both in San Francisco and Oakland.

The author has made a careful study of the regulations and rules and laws of the Forest Service and the Department of the Interior in so far as they relate to hydroelectric development and control. The opinions in regard to the effect of the present rules and regulations and stipulations differ so widely that it is almost impossible to determine what changes in the present laws or what recommendations as to alterations in pending legislation will make for the more rapid development of hydroelectric power. Certainly the main ideas that are debatable are the revocable permit, the definite franchise stipulation, the matter of just compensation, and the power to be exercised over the complete operations of the company as to conduct and rates. These appear to be the crucial points in all the present legislation and proposed legislation in regard to the power companies. If these can be adjusted, the author believes that the financing of the companies and the development of water power can be readily secured.

The deficiency in power during the last year approximated 25,000 kw. for safe operating, and as the normal growth is between 20,000 kw. and 25,000 kw., there is great need for increased generating capacity. Besides this need there is the further need for the replacement of the use of fuel oil by hydroelectric development, and this should be carried out at the rate of about 50,000 kw. per annum until the oil-generated power is reduced to a safe and economical value.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

WHAT A WATER BALANCE OF THE PLANT MAY SHOW

Inefficiencies That Might Escape Notice for a Considerable Period Are Brought to Light and Definitely Located by This Method

BY EDWARD MARSHALL

An important power-plant problem is the checking up of steam after it has been generated. Occasionally a water balance of a plant should be taken. It may show that operators permit blowing off of many steam siphons for hours at a time, or that the steam ejector is being used on a LeBlanc air pump because the vacuum cannot be held up without it, or that the distributer is choked with sticks and stones, or that some of the nozzles and blading of the small turbines are so worn that they take twice the correct amount of steam, or that feed-water heaters have not the proper baffling and the air vents to utilize and absorb the minimum amount of exhaust steam to give maximum water temperature, or that valve settings on stoker, engines, air compressors, dry-vacuum pumps, etc., are so far off that an excessive amount of steam is being used. It may be possible that such a test will show a difference of 33⅓ per cent between the steam fed to the main units and the water fed to the boiler. If that is the case, it is time to look for the leaks.

HIGH RATINGS FOR BOILERS IN EASTERN POWER PLANT

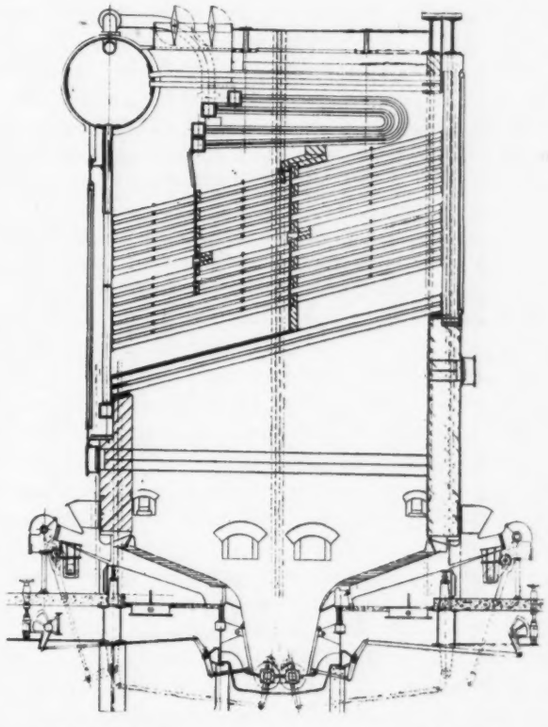
Boilers Rated at 1529 Hp. and Equipped with Double Fourteen-Retort Underfeed Stokers Expected to Deliver Up to 400 per Cent of Rating

The new plant of the West Penn Power Company, to be built on the Allegheny River near Freeport, Pa., contemplates some decidedly novel featues in the boiler and stoker equipment. The initial installation is designed for six boilers of the cross-drum vertical-header type, forty-two sections wide, sixteen tubes high, 20 ft. (6 m.) long, set with the front header 16 ft. (4.9 m.) above the floor.

Each boiler in the plant is rated at 1529 hp. and is equipped with superheaters designed to give 200 deg. Fahr. (93 deg. C.) superheat. Underfeed stokers are to be installed at the front and rear with fourteen retorts under the mud drum and fourteen retorts under the front of the boiler. The maximum operating conditions are to be 300 lb. (21 kg.) gage pressure and 200 deg. Fahr. (93 deg. C.) superheat.

The boilers will be set in two rows with aisles about 15 ft. (4.6 m.) betwen the boilers, thus giving plenty of room around each boiler for proper operating facilities. The stoker drives are so divided that either seven or fourteen retorts can be driven by one prime mover. The wind-box dampers are arranged to control the air separately for units of three or four retorts. The stokers are to be equipped with clinker grinders for continuously removing the ash and clinker. Pittsburgh coal will be used with approximate analysis ranging from 11,500 B.t.u. to 13,500 B.t.u. and 7 per cent to 14 per cent ash.

The boiler equipment is so designed that the flue-gas temperatures will range from 500 deg. Fahr. (260 deg. C.) at 150 per cent of rating to 700 deg. Fahr. (370 deg. C.) at 300 per cent of rating, the combined efficiency ranging from 75 per cent at 150 per cent of rating to 65 per cent at 350 per cent of rating. Each stoker, when burning the fuel for which it is designed, is expected to develop 350 per cent of boiler rating continuously with the clinker grinder in operation and 400 per cent of boiler rating for peaks of short duration. Under these operating conditions the combustible in ash is not to exceed 14 per cent. The ash is to be discharged into water-sealed ash pits.



WITH THIS EQUIPMENT STOKERS FEED COAL FROM BOTH FRONT AND REAR

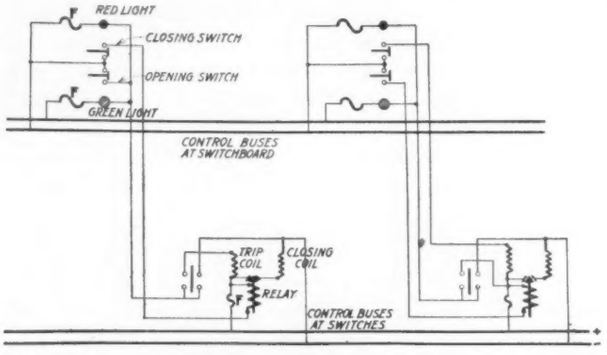
The facts contained in the preceding paragraphs concerning the installation of the West Penn Power Company were given to the station and operating committee of the Ohio Electric Light Association at the meeting held recently at Cincinnati, Ohio.

REMOTE-CONTROL WIRING PLAN FOR SWITCHBOARDS

Two-Wire Connection Between Control Switches and Oil Switches Can Profitably Be Changed to Three-Wire Circuit

BY K. B. AYRES

Switchboard equipment for central stations should be made as free as possible from trouble that can in any way cause an interruption of service. One point that is often overlooked is illustrated in the accompanying



TWO-WIRE AND THREE-WIRE CONNECTIONS BETWEEN CONTROL SWITCHES AND BREAKERS

figure. While it may not cause trouble for long periods of time, it has been known on several occasions to cause service interruptions of considerable importance.

It will be seen on the left of the figure, which shows two control wires running between the control switches at the switchboard and the operating coils at the oil switch, that these two wires not only carry the operating energy at the time of operating the switch but also serve to complete the circuit for the pilot lamps. This being the case, it is necessary that the trip coil be in circuit with the red lamp which is lighted when the switch is closed.

As a rule the lamps used for this purpose are the small style "E" with the candelabra base, and the energy for the operation of the switches and the lighting of the pilot lamps is taken from the exciter buses. At times the voltage may rise to rather a high point so that there is danger of the red lamp short-circuiting in the base when it burns out, in which case it throws the trip coil across the line, having the same effect that operating the opening switch would have. Of course, this light has a fuse in circuit with it, but almost invariably the damage is done before the fuse can open the circuit.

On the right-hand side of the figure a third wire is shown between the switchboard and the oil switch so that the control circuit and the signal circuit are kept separate, thereby eliminating the possibility of trouble on the signal circuit throwing out an important feeder or generator.

Doubtless there are a large number of stations operating with the two-wire plan of control and signal wiring, inasmuch as some of the largest manufacturers of switchboards in the country have furnished to their customers wiring diagrams showing the two-wire system of connection between the control switches and the oil switches.

The cost of changing from the two-wire to the three-wire system is in no way prohibitive as the two-conductor control cable removed can always be used for other purposes. The labor of making the change is not great as the three-wire control cable can be tied to the two-wire cable before it is pulled out, so that as the two-wire cable is removed the three-wire is at the same time pulled into the conduit.

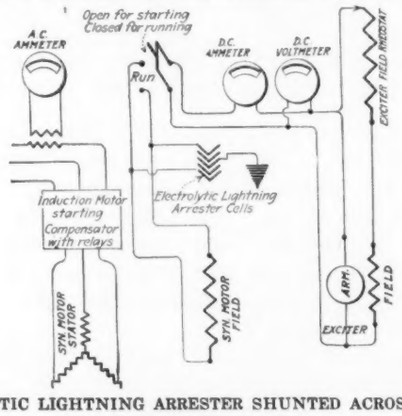
ELIMINATING TROUBLE IN SYNCHRONOUS MOTOR FIELD

In Case of Dangerous Voltage Rise a Section of Electrolytic Arrester Is Placed Across Motor Field Circuit

BY J. A. OBERMAIER

In a plant where several 100-hp. synchronous motors were started frequently trouble arose due to the field winding insulation breaking down during the starting period. After trying the usual methods for limiting or reducing the voltage rise during the starting period without success, the following method was recommended and employed. An electrolytic lightning arrester, consisting of the proper number of trays mounted and filled in the usual manner, was connected directly across the slip rings of the field. The accompanying sketch shows the general arrangement of the complete motor circuits. The motor stator winding was energized at starting through the starting compensator. During the starting period the field was not energized. When the machine reached approximately normal speed the field switch was closed and the field was energized with direct current in the usual manner. This method of starting has given very good service and is considered reliable. However, for severe starting duty the cells must be inspected at least once every six months.

The sketch shows five electrolytic trays connected solidly to the field winding, the middle tray being tapped to ground to divide the stress on the winding equally. The function of this apparatus was as follows: The number of trays selected was determined by the allowable



ELECTROLYTIC LIGHTNING ARRESTER SHUNTED ACROSS FIELD TO AVOID VOLTAGE TROUBLE

voltage rise across the field. In this case it was assumed that the insulation would stand 1500 volts. The breakdown point of an electrolytic cell is approximately 300 volts. Thus with five cells when the voltage exceeds 1500 volts during the starting period the electrolytic arrester breaks down, causing a considerable discharge of current through the field winding, thereby limiting the induced voltage. When the voltage returns to normal value the arrester is restored to normal.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

SOCKET APPLIANCES ARE SOLD ON A CASH BASIS

Partial-Payment Plan Discontinued on Large Devices in Order Not to Tie Up in This Manner More Money than Necessary

Although the policy of selling appliances on the partial-payment plan had been well established, the Little Rock (Ark.) Railway & Electric Company some time ago discontinued the practice of the sale of vacuum cleaners, washing machines and other large household socket devices on easy terms. This was done in order not to tie up any more money than was necessary in appliances. However, with increased efforts the company in the month of December last, for instance, disposed of nine vacuum cleaners and one washing machine. This shows that sales can be made on a cash basis.

CLEVELAND COMPANY CHANGES POLICY OF MAKING EXTENSIONS

Customers Are No Longer Asked to Finance Public Utility Construction on Installations Larger than 5 Kw. of Rating

On Jan. 1 the Cleveland Electric Illuminating Company withdrew its schedule, which was on file with the Public Utilities Commission of Ohio, covering line extensions and increases for service in excess of 5 kw. of rating. For fourteen months prior to that time the Cleveland company asked consumers in this class to advance the entire cost of making extensions and increases, and under this schedule the so-called normal cost of the work, which was the estimated cost on the basis of July 1, 1914, was refunded to them over a period of years, the rate of refund depending on the use of the service.

The company's policy now for large extensions and increases is the same as it was for years prior to the war. Under this policy the company will make extensions and increases of its lines and service wherever there is business which in its judgment justifies the investment of money necessary to make the increase.

In commenting on the change in policy G. E. Miller, sales manager of the company, said: "The schedule under which consumers were asked to pay for new service or additional service was of course a war measure, and since it is now possible for us to finance our reasonable requirements, we feel that it is only good business policy to follow the practice which the company had pursued in years past.

"Incidentally the company's load continues to hold up in a rather surprising way, as up to date there has been no decrease whatever in its maximum load and the prospects for additional new business are very good."

THE FREE LAMP RENEWAL POLICY RE-ESTABLISHED

Management of Hartford Company Believes that Public Is Better Served Thereby and that a Closer Touch Is Kept with Customers

Two weeks after the signing of the armistice the Fuel Administration of Connecticut relaxed the restrictions which had been placed upon lamp renewals and the use of energy for lighting, and the Hartford Electric Light Company reëstablished the policy of free renewals on the larger sizes of type B and type C lamps. Inquiry by a representative of the ELECTRICAL WORLD as to the reasons for restoring free renewals at Hartford brought out two main points which determine the company's policy: First, the management believes that the convenience of the public is better served by free renewals on the larger sizes of lamps; second, the company is enabled by this policy to keep in closer touch with its customers' installations and present and prospective wants.

The general desire of the company's customers, as repeatedly expressed to the management, is to have the cost of lamp renewals covered in the monthly bills for service. Should the public desire to pay for lamps separately, the company would put such a policy into effect, but the evidence is overwhelmingly the other way at Hartford. Widespread satisfaction was expressed by the company's customers when the improved fuel conditions following the end of hostilities abroad permitted the reëstablishment of the free renewal plan. Neither the company nor the public in Hartford overlooks the fact that the cost of free renewals must be covered in the price of service.

The supply of lamps below list price in the renewal of the smaller sizes, 15-watt and 25-watt type B's and 100, 150 and 200-watt type C's, also, combined with free renewal of the larger sizes, whether clear or frosted, brings the customer into much closer touch with the company than if these lamps were purchased in the open market. The customer's sockets are better filled; there is less borrowing of lamps to take the place of those which have outlived their usefulness, and the percentage of dead sockets is lower. Moreover, the company's knowledge of the individual connected load and the service conditions tends to protect both the customer and itself from poor service and complaints due to the under-illumination of many premises. The company is selling illumination in the last analysis, and neither lamp nor energy cost can properly be overlooked in the price of service. Incidentally, the public objected strenuously to the cutting down of the free renewals forced by the war.

The relation of the contractor-dealer to the Hartford policy is interesting. For the first installation a charge

at list is made on all lamps, so that the contractor-dealer has the opportunity to furnish lamps on a profitable basis to himself, just as he enjoys a profit on the rest of the material installed. The Hartford company does not maintain its free renewal policy on the ground that the quality of lamps sold by contractor-dealers is inferior to that supplied by the central station, but the management feels that the contractor-dealer's connection with the lamp installation policy terminates with the completion of the wiring job, and that thereafter the central-station interest predominates. In order to prevent the use of lamps in improper locations where the mechanical breakage would be excessive, as in gar-

The Hartford Electric Light Company MAZDA LAMP PRICES—NOV. 25, 1918

SIZE IN WATTS	NUMBER IN STD. PACKAGE	STYLE OF SCREW BASE	DIAMETER IN INCHES	LENGTH IN INCHES	LIGHT CENTER LENGTH IN INCHES	SALES PRICE Clear or Frosted	RENEWAL PRICE Clear or Frosted
REGULAR LAMPS							
15	100	Regular	2¼	4⅝		.33	.25
25	100	"	2⅝	5¼		.33	.25
40	100	"	2⅝	5¼		.33	Free
60	100	"	2⅝	5½		.45	"
100	24	"	3⅝	7⅛		.92	"
CONCENTRATED FILAMENT LAMPS Enclosing Globes or Indirect Fixtures are Recommended for Use With These Lamps							
100	24	Regular	3⅛	7⅛	6⅛	1.10	1.00
150	24	"	3⅛	7⅛	6⅛	1.65	1.50
200	24	"	3⅝	8⅜	6	2.20	2.00
300	24	"	4⅝	10¼	7½	3.25	Free
400	—	Mogul	5	10	7	3.25	"
500	—	"	5	10	7	3.25	"
750	—	"	6½	13⅝	9½	5.00	"
1000	—	"	6½	13⅝	9½	5.00	"

10% Discount for Standard Package Quantities.

Note: In order to prevent the use of lamps in improper locations where the mechanical breakage would be excessive, the Company restricts the Free Renewals to one lamp per socket per year.

HARTFORD SCALE OF LAMP PRICES

ages, shops, etc., the company restricts the free renewals to one lamp per socket yer year. A 10 per cent discount is given when lamps are purchased in standard-package quantities.

With the exception of lamps, the Hartford company stands ready at all times to supply contractor-dealers with appliances selling below list in special campaigns or otherwise at prices which enable the contractor-dealer to realize a profit in merchandising such articles at the central-station prices.

UTILITY STARTS BUREAU TO STUDY PROFIT SHARING

New Operating Research Bureau of Milwaukee Company Created to Carry on Certain Functions of Management

A new organization known as the Operating Research Bureau was started by the Milwaukee Electric Railway & Light Company on the first of this year. It was created for the purpose of carrying on certain of the functions of management in dealing with the research work required by the company and its subsidiary.

At first the work of this bureau will be confined largely to investigating and standardizing existing profit-sharing plans with a view of taking advantage of past experience. Extensive and comprehensive study will also be required to place all plans on a basis which will as far as possible recognize individual effort to a greater extent. The bureau will coöperate with the various departments in devising new plans for profit sharing where practicable in divisions not now participating. It will prepare monthly a summary of results achieved by the profit-sharing plans in each department and comment thereon in a monthly report. Data necessary for these reports will be obtained from the representatives appointed in each department to coöperate.

The bureau will likewise assume charge of all valuation work required from time to time. In connection with this work and the profit-sharing plans unit costs will be developed. Such cost information is to be kept in a manner suited to use of the departments for estimating purposes. The bureau will also be called upon to make time studies and will develop the facilities.

The operating research bureau is under the direction of William Baum, research engineer, and Ralph Moody, assistant research engineer.

WAR-LINE CONSTRUCTION COSTS FINANCED BY CUSTOMERS

Knoxville Plan Provides for 60 per Cent Refund, Payable Semi-Annually, on Basis of 25 per Cent of Net Bills in Twenty-four Months

A special agreement for service extension whereby the excess cost of line construction over normal cost is borne by the consumer has been put into force by the Knoxville (Tenn.) Railway & Light Company.

According to this agreement the consumer pays the company the estimated cost of the construction. If this construction cost does not amount to the estimate, the balance is refunded to the consumer immediately, while if the estimated amount is not sufficient to pay the construction cost, the consumer agrees to pay the balance. The refund clause of the contract makes the following provisions: The company agrees to refund to the customer 60 per cent of the amount paid by the customer for the construction of the line, such refund to be 25 per cent of the amount of the customer's net payment to the company for electric service during the first twenty-four consecutive months after connection is made to the customer's premises, provided, however, that no refund shall be in excess of 60 per cent of the construction cost, nor shall any refunds be made from payments for service after the first twenty-four consecutive months so named. The amount of refund is to be calculated and paid on Jan. 1 and July 1.

"Therefore," says W. R. Sammons, commercial manager of the company, "where a line extension is estimated to cost $50, the consumer pays this amount before the work is started, but in event that the work costs actually $40, $10 is immediately returned. Assuming that the monthly net bill averages $3, or $18 for six months, the amount of $4.50, or 25 per cent of the net bill, is refunded to the consumer by voucher at the end of six months and charged against the construction account. The consumer will be entitled to a full refund of 60 per cent of $40, provided that 25 per cent of the total net bills for twenty-four months amount to this sum. The average net bills, however, of $3 a month make a refund of $4.50 for each six-month period, or $18 in twenty-four months, which constitutes the total refund. If the average net bills amount to $6, the six-month refund will be $9 and the consumer will have earned a refund of the entire 60 per cent at the end of sixteen months."

The agreement also contains a clause whereby the consumer agrees to pay a certain minimum amount, which apparently is based upon extension conditions. This system, it is reported, is working out very well.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Formulas and Charts Relating to the Performance of Industrial Transformers.—L. DUBAR.—Constructors have continually need of determining rapidly the output and voltage drop of transformers under varying conditions. In this article the author gives charts designed to obviate long processes of calculation by a simple alignment of points.—*Revue Générale de l'Electricité*, Nov. 30, 1918.

New Graphic Method for Winding Schemes.—L. FLEISCHMANN.—There are two ordinary methods of graphic representation of winding schemes. In one the conductors are arranged in the drawing exactly as they lie on the armature, but in the Arnold plan the scheme has to be prepared from the winding formula. There is a change from the actual number of poles to the number which corresponds to that of the circuits, and questions of drum winding and ring windings are involved. The new method proposed by the author is similar to Arnold's but avoids the change in the number of poles and the passage from drum to ring.—London *Electrician*, Dec. 13, 1918.

Special Transformer Connections.—M. VIDMAR.—The usual forms of three-phase transformers are not quite symmetrical. The differences between the three magnetic paths cause the magnetizing currents to be unequal, and the situation of the center core between the outer ones gives rise to a greater temperature rise in the center core. These differences may be removed to some extent by winding the cores with unequal numbers of turns. This affords a means of shifting the star point of the transformer to any desired extent along the median line of the three-phase vector triangle. The angle between either of the outer phase voltages and the line voltage between the outer phases has the value 30 deg. in the balanced transformer. If unbalanced windings are used to balance the magnetizing currents, it is possible to obtain a true neutral point by the addition of an auxiliary boosting winding on the middle phase to counteract the shift of the neutral point by the change in the voltage angle. The true neutral may also be obtained in an unsymmetrically wound transformer by zigzag connections between the halved three-phase windings. It is shown that a decrease in the voltage angle involves an increase in the amount of copper and a decrease in the amount of iron, and *vice versa*. The unequal heating of the limbs is reduced by an increase of the voltage angle beyond 30 deg., which throws part of the winding of the central core onto the outer core, and by adjustment of the sections of the three cores equal magnetizing currents may be obtained in the three phases.—*Science Abstracts, Section B*, October 1918. (Abstracted from *Electrot. Zeits.*, July, 1918.)

Generation, Transmission and Distribution

Modern Boilers.—L. CONGE.—A discussion of the boilers used in central stations with steam-driven generators. The makes of boilers illustrated and discussed include the Garbe, Stirling, Woodeson, Buttner-Leflaive, Babcock-Wilcox, Babcock with high evaporative feature, marine-type Babcock, Robert, Belleville, Niclausse and Romanet.—*Revue Générale de l'Electricité*, Nov. 9, 1918.

Saving the Waste in the Chimney.—ROBERT SIBLEY and CHARLES H. DELANY.—To understand properly how to save the waste occasioned by the chimney and its accessories in the modern oil-fired power plant a knowledge of the fundamental laws of chimney design is necessary. This article is the first of a series on this subject aiming at increased power-plant fuel economy.—*Journal of Electricity*, Nov. 15, 1918.

A Plan for Power Development.—C. EDWARD MAGNUSSON.—A basic plan for natural water-power development which applies the principle of the Reclamation Service to the electrical field; a new idea which permits of government aid without doing away with private enterprise.—*Journal of Electricity*, Nov. 15, 1918.

Some Experiments with Long Electrical Conductors.—JOHN H. MORECROFT.—Working at frequencies from 12 to 152 cycles per second, an artificial antenna made up of numerous sections, each having lump capacity and inductance and closely simulating an actual antenna, is carefully studied. The effective capacity, inductance and resistance are measured and found to agree with theory, and the theoretical effects of capacity and inductance loading are similarly experimentally verified.—London *Electrician*, Dec. 6, 1918.

Floating Electric Power Station.—Among the many war problems calling for solution has been the question of electric power supply to meet variable conditions overseas. A description is here given of a plan giving the necessary mobility and convenience for harbor duty, which was designed under the direction and for the service of the Directorate of Inland Waterways and Docks, War Office. It takes the form of a floating electric power station, and the nature of the duty calls for a wide range of supply. Direct-current supply can be given between 100 volts and 75 volts and alternating current from 200 volts to 7600 volts. The plant is installed on a large steel barge, and the accommodation consists of two dynamo rooms and a boiler room.—London *Engineering*, Dec. 6, 1918.

Present Status of Hetch Hetchy.—RUDOLPH W. VAN NORDEN.—The Hetch Hetchy water and power project undertaken by the city of San Francisco is one of the most stupendous pieces of work of its kind. In this

article is presented a most comprehensive survey of the project, its scope and the progress to date, as well as difficulties encountered and possibilities for the future.—*Journal of Electricity*, Nov. 15, 1918.

Traction

Electrification of the Melbourne Suburban System.—E. P. GROVE.—The first article of this series described the Newport power station. The present article deals particularly with the overhead equipment of the permanent right-of-way, which constitutes a very extensive system. A system of 1500 volts direct current is used on the trolley supported by a simple catenary suspension. The messenger wires in turn are supported from bridge structures along the right-of-way.—*Commonwealth Engineer*, Nov. 1, 1918.

Vibration of Electric Locomotives.—P. LEBOUCHER.—The author, premising that the problem of rapid transit is still far from satisfactory solution from either the mechanical or the electrical point of view, argues in favor of the entire suppression of driving rods in electrical locomotives. The vibrations of the frame caused by them are obviated by those systems of gear in which the motor acts directly upon the axle. The future of rapid electrical transit lies along these lines.—*Revue Générale de l'Electricité*, Dec. 14, 1918.

System of Braking with Recovery of Energy.—Dr. BEHN-ESCHEBERG.—After a brief notice of the different modes of electrical braking employed hitherto, the author describes the method used at the Oerlikon construction plant for the single-phase locomotives of the St. Gothard railway and explains the theory of regeneration on which the system is based. It permits of the extension of braking with regeneration to all loads and all speeds down to the lowest. A reactance coil is the only addition to the normal motor installation.—*Revue Générale de l'Electricité*, Dec. 7, 1918.

Installations, Systems and Appliances

Oil Disconnecting Switches.—W. A. COALES and W. H. WADMORE.—The authors specify nine conditions that a circuit breaker ought to satisfy. They discuss the use of these appliances in combination with relays and their performance with single and double busbars and with ring connection. It is not always the case that circuit breakers are the ideal system for great installations at low tension, because of the very great care necessary in regulating the relays. The use of reactors in the generator circuits and in the sections of the busbars is for this reason becoming more and more common in spite of their high price and their great bulk. While limiting the power that can pass from one side of the system to the other, they have the advantage of never opening the circuit.—*Revue Générale de l'Electricité*, Dec. 7, 1918.

Employment of Synchronous Motor to Improve Power Factor.—PAUL RIEUNIER.—A long article on this subject in which the author analyzes the methods of improving power factor by the use of the ordinary apparatus of electric power houses.—*Revue Générale de l'Electricité*, Nov. 23, 1918.

Supply of Single-Phase Power from Three-Phase Systems.—MILES WALKER.—The various methods of supplying single-phase power are considered. The correct method of balancing the phases in the case of an electric furnace working at 0.7 power factor is developed for both choke-coil balancer and the condenser balancer. Rotating balancers are classified under five sub-headings, and the merits and drawbacks of these balances are discussed. A new type of balancing transformer is described, and a calculation of a balancing transformer for feeding a 400-kw. electric furnace is worked out.—London *Electrician*, Dec. 13, 1918.

Contactor Control Gear in Industrial Work.—Automatic control, besides acting as a measure of safety, may considerably reduce the costs of maintenance. An instance is described giving the experience of the British Westinghouse Company in a certain steel mill with two motors. With hand-operated control the armatures had to be replaced in about two weeks, frequently requiring new coils and commutators. After the installation of an automatic controller the motors ran for two years without requiring any repairs to the armatures. In many cases automatic control brings other benefits; for example, it may facilitate simpler driving, smaller consumption of energy and speedier operation. A detailed discussion of crane controllers follows with wiring diagrams.—London *Electrician*, Nov. 29, 1918.

Electric Welding in Shipbuilding.—COMFORT A. ADAMS.—In this article Professor Adams enumerates all of the facts of importance that bear on the subject of electric welding and briefly discusses each. Among these factors are the question of when to use arc or spot welding, electrodes for arc welding, training of arc welders, the use of direct or alternating current, size of electrodes and strength of current, automatic arc-welding machines, strength of welds, relative cost of welding over riveting, etc.—*General Electric Review*, December, 1918.

Arc Welding in Shipyards.—W. L. ROBERTS.—Both resistance and arc welding are employed in shipbuilding. In this article Mr. Roberts describes some of the applications of arc welding. He first shows how the anglesmith's work is facilitated by the use of arc welding in the production of staples, and then predicts that the use of staples will soon be abandoned in favor of directly arc-welding together the parts to be joined. Other sections of his article are devoted to descriptions of the application of the electric arc to the construction of water, oil and air tanks, stacks, condensers, ballast tanks, etc.—*General Electric Review*, December, 1918.

New Method of Cleaning Condenser Tubes.—T. G. OTLEY.—By means of an air pistol water with sand in suspension was blown through the tubes. A modification of this method was proposed by G. Hall in which sand was introduced into the condenser tubes by means of the circulating water. About 1½ cu.yd. (0.4 cu.m.) of sand was added to the water daily, and after three weeks of this treatment the condition of the condenser became satisfactory.—*Proceedings* South African Institution of Engineers, October, 1918.

The Lifting Magnet a Valuable Piece of Laboratory Apparatus.—L. A. DOGGETT and C. A. STYER.—Experiments are described with lifting magnets to bring out the following points: (1) Magnetization curve and saturation, (2) hysteresis effects, (3) law for the pull exerted by an electromagnet, and (4) effects of inductance in an electromagnet. It is thus pointed out that the

lifting magnet forms a valuable piece of laboratory apparatus.—*Proceedings* Society for the Promotion of Engineering Education, November, 1918.

Note on Effect of Temperature on Resistance of Spark-Plug Insulation.—J. D. MORGAN.—The question here discussed is how the conductances of plug insulations at temperatures found in engine cylinders are sufficient to short-circuit the high-tension system of a magneto or induction coil and thereby extinguish sparking of plugs. Curves are plotted between resistance and temperature showing the critical temperature above which the resistance is very low. Other curves are plotted between resistance and the rapidity with which sparks occur for various combinations of spark plugs and engines.—London *Engineering*, Nov. 8, 1918.

Power from the Tides.—In this article J. O. Boving, who has been studying the problem for some years, puts forth proposals with special designs of turbines which may possibly help toward rendering the utilization of tidal power economically feasible.—London *Times Engineering Supplement*, November, 1918.

Electrochemistry and Batteries

Electric Furnaces in Metallurgy.—The war has brought the electric furnace into prominence very much more quickly than would have been the case under normal conditions in this country. One reason is that these furnaces are particularly suited for the production of special alloys, and such alloys have been in very great demand. Another reason is the large amount of steel scrap that has been available during the war. It has therefore come about that, whereas the electric furnace was used somewhat experimentally before the war, it is now being used commercially in increasingly large numbers. The Héroult furnace considered particularly in this article has increased in its business in a manner strikingly shown by curves presented by the author. He states that since the outbreak of the war the number of Héroult furnaces in Great Britain has increased from five to fifty-four, and the transformer capacity from 3500 kva. to 50,000 kva. The present output is at the rate of about 150,000 tons per annum, and this amount should be almost doubled before the end of the year.—London *Electrician*, Nov. 15, 1918.

Ionization of Mercury, Sodium and Potassium Vapors and the Production of Low-Voltage Arcs in These Vapors.—T. C. HEBB.—It has been shown that: (1) Potassium vapor can be ionized at 1.6 volts, its resonance voltage. (2) Sodium vapor can be ionized at 2.5 volts, which is very close to the resonance voltage. This result agrees with that found by Wood and Okano. (3) The *D* lines of sodium can be excited at less than 1 volt; also in agreement with Wood and Okano. (4) The sodium and potassium arcs in mercury vapor can operate below their resonance potentials and as low as 1.4 volts for sodium and 0.5 volt for potassium. (5) The mercury spectrum can be produced as low as 0.5 volt in an atmosphere of mercury and potassium.—*Physical Review*, December, 1918.

Telegraphy, Telephony and Signals

Fundamental Formula in Radio Transmission.—L. BOUTHILLON.—For radio transmission with damped oscillations over flat and perfectly conducting ground, with the air regarded as a loss-free dielectric, the following formula giving the current at the base of the receiving antenna may be deduced theoretically:

$$I_r = 377 \frac{I_s}{R} \frac{h_1 h_2}{\lambda d} \div \sqrt{1 + \delta_1/\delta_2}$$

I_s is the current at the base of the transmitting antenna, R is the total resistance of the receiving antenna, d the distance apart in centimeters, $h_1 h_2$ and $\delta_1 \delta_2$ are the respective effective heights and decrements of the two antenna. In the present paper some early experiments by Tissot are used to calculate the value of the constant of the formula, neglecting the transmission absorption term. The value deduced from the experiments is 390, which is in good agreement with the theoretical value. In the discussion, O. C. Roos pointed out that it is possible that Bouthillon has not deduced the proper form-factor, which would involve a change in the decrement of the receiving antenna. Allowing for this, the value of the constant might be considerably nearer the theoretical value.—*Science Abstracts, Section B*, October, 1918. (Abstracted from *Proceedings* Inst. Radio Eng., August, 1918).

Radio Communication with Moving Trains.—F. H. MILLENER.—The radio-telegraphic researches carried on under the auspices of the Union Pacific Railroad are described. A radio "danger" signaling system was first worked, but, while operable, it did not give the extreme reliability required by such systems. A radio-controlled car is described, and a series of experiments with arc radiophone equipment are considered. Their applications to inter-car wire telephone communication and train-to-station radiophone communication are given in detail. The necessary fixed stations are also described. The experimental radio-telegraphic car laboratory is then taken up, together with the antennas, ground, engine and transmitter thereof. Finally, receiving sets and a telephone-relay amplifier (intended to facilitate telegraphone or dictaphone recording of signals) are considered.—*Science Abstracts, Section B*, October, 1918. (Abstracted from *Proceedings* Inst. Radio Eng., August, 1918.)

Miscellaneous

Some Field Experiments on Evaporation from Snow Surfaces.—F. S. BAKER.—The experiments could not be carried out on windy days when the snows was drifting or during periods of snowfall, but they fully cover the calm, clear days of winter. The total loss during the winter 1915-16 was found to be equivalent to 3 in. (7.6 cm.) of water or 14 per cent of the total snowfall. A graph exhibits the relation between evaporation and temperature, showing a rapid rise at the higher temperatures.—*Science Abstracts, Section A*, October, 1918. (Abstracted from *Monthly Weather Review*, July, 1917.)

Economics of Works Costs.—J. R. DICK.—The author indicates the use of some elementary mathematics and curves on cross-section paper to aid in the discussion of the cost of manufactured products as affected by labor and investment.—London *Electrician*, Nov. 29, 1918.

Fusibility of Coal Ash from West Virginia Coals.—WALTER A. SELVIG.—The method of preparing ash for fusion tests and determining initial softening temperature and the interval of fusion are described in this article. Tables are presented giving a summary of tests of West Virginia coal—*Chemical and Metallurgical Engineering*, Dec. 15, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ARMY ENGINEERS TO REPORT ON POWER IN NEW ENGLAND

Report Will Give Comprehensive View of Power Needs with Map of More Important Systems and Study of Interconnection

Based on the work of the army officers detailed to investigate the power requirements of New England industries and under the direction of Major Carroll H. Shaw, Engineers, U. S. A., who was in charge of the New England district for the power section of the War Industries Board, a report is now in preparation covering the power requirements and resources of the New England States. It is expected that about three months will be required to complete the report, which will give a comprehensive view of the power needs of the section covered, with a map of the more important transmission systems of electrical energy and study of possible interconnection developments. It is expected that the report will provide many data which will be of service in connection with federal franchise legislation, if such is discussed in the near future.

NATIONAL SERVICE COMMITTEE OF ENGINEERING COUNCIL

M. O. Leighton Made Chairman of a New Committee to Have Headquarters in Washington to Render Service to the Nation and the Profession

In order to provide better for united action upon matters of common concern to engineers, the Engineering Council has recently organized a national service committee and has established an office in the national capital. This action was based upon a tentative plan for representation of engineers at Washington submitted to the council at a special meeting on Nov. 21, 1918, by Philip N. Moore of the American Institute of Mining Engineers.

The Engineering Council, through this national service committee and its Washington office, intends to accomplish the following general purposes, this committee acting always under the direction of the council and within limitations fixed for it:

1. To discover public services which may best be performed by engineering societies, and, when desired, to offer the proper men for such services.
2. To speak authoritatively for the Engineering Council before committees of Congress and departments of the government on all public questions of common interest to engineers, within such limitations as the council may set from time to time.
3. To give promptly wide circulation among engineers to authentic information regarding pending legislation and executive actions which may affect the interests of engineers in any way.
4. To gather opinions of engineers on these matters.

The Engineering Council's aim is disinterested usefulness to the nation and the profession—not advocacy of any selfish ends—by giving unbiased information and counsel on technical matters, chiefly when asked. A modest start is being made. The work will be enlarged only as a real demand for services develops.

The members of the national service committee have been chosen so as to represent different parts of the country. They are: Chairman, M. O. Leighton, Washington; C. B. Burdick, Chicago; George F. Swain, Boston; Philip N. Moore, St. Louis; L. D. Ricketts, Warren, Ariz.; Andrew M. Hunt, San Francisco and New York; Andrew M. Lockett, New Orleans; W. C. L. Eglin, Philadelphia; Bancroft Gherardi, New York.

The Washington office is at 502 McLachlen Building, Tenth and G Streets.

STORM OF PROTESTS AGAINST NEW TELEPHONE RATES

Many State Commissions Take Action Against Schedules Promulgated by the Postmaster-General—Proceedings Before the Massachusetts Commission

A storm of protests and prompt official action by many of the state public service commissions has followed analysis of the new telephone rates promulgated by the Postmaster-General. Investigation showed many increases in rates, although the impression had prevailed that the new schedules meant decreases. Representatives of nineteen states met in Chicago and passed resolutions declaring that the Postmaster-General had exceeded his legal powers. Some of the state commissions have asked for injunctions against the establishment of the new rates; others have confined their action to refusal to approve the schedules. It is announced in Washington that the Post Office Department will enforce the rates except where courts have granted restraining orders.

Among the states which have taken action against the rates are Illinois, Massachusetts, Michigan, Ohio, Florida, Nebraska, New Jersey, Missouri, West Virginia, Nevada, Arizona, Connecticut and New York (Second District).

Proceedings before the Massachusetts Public Service Commission, which made public an analysis of the rates, are reported to the ELECTRICAL WORLD as follows:

Following an all-day hearing at Boston Jan. 17, at which it was clearly demonstrated that the telephone toll rates recently ordered by the Postmaster-General represent a substantial advance over the previous schedule, the Massachusetts Public Service Commission suspended the proposed rates, prepared to carry the issue to the courts if necessary to enforce the finding of the board.

Postmaster-General Burleson was represented at the Massachusetts hearing by Matt B. Jones, vice-president of the New England Telephone & Telegraph Company. Mr. Jones read a letter from W. H. Lamar, solicitor for the Post Office Department, in which it was announced that the purpose of the new toll rates is to effect a standardization of charges for such service on a nation-wide basis, and that the question of revenue to be derived therefrom was merely incidental. It was pointed out that there are many serious irregularities and inconsistencies in the existing rates, and that in removing these some rates would run higher and some lower, in different sections of the country. No discrimination was intended against the people of Massachusetts, the letter stated, and the coöperation of the commission was urged in giving the new rates a trial and in preparing to equalize exchange telephone rates in the future. Representatives of municipal governments and of chambers of commerce in many of the principal cities and towns of the state were present at the commission's invitation, and widespread opposition was recorded against the proposed establishment of toll rates along the lines fixed by the government (Bulletin 22 and Order 2495).

Chairman Macleod questioned the materiality of a nation-wide rate equalization of rates as a basis for increasing the charges for Massachusetts service. During the hearing exhaustive tabulated data were presented by William H. O'Brien, chief of the telephone and telegraph department of the commission, showing the increases which the new rates signify. A station-to-station rate forms the basis of the new charges, with a report charge on all person-to-person business. The rates will in general be increased by the schedule on both long-haul and short-haul service. A few instances of the increases which will result on interstate calls are given below:

PRESENT RATES AND RATES OF POSTMASTER-GENERAL

Boston to	Present Person-to-Person Charge	New Person-to Person Charge	Proposed Station-to-Station Charge	Report Charge
Portland, Me.	$0.65	$0.85	$0.70	$0.20
Augusta, Me.	.90	1.30	1.05	.30
Bangor, Me.	1.35	1.65	1.35	.35
Manchester, N. H.	.35	.50	.40	.10
Burlington, Vt.	1.15	1.50	1.20	.30
Providence, R. I.	.30	.40	.35	.10
New Haven, Conn.	.90	1.00	.80	.20
Hartford, Conn.	.75	.80	.65	.20
New York City	1.25	1.55	1.25	.35

Mr. O'Brien also presented data sheets analyzing about 200 intrastate toll rates and showed that in the great majority of cases the new charges will be higher than the former tariff, although for some unexplained reason, he said, the administration has exempted the Boston metropolitan district in this so-called "standardization" of rates. Mr. Jones made no claim that the rates are established on account of the financial needs of the New England company, but said that if the government had not taken over the telephone systems during the period of hostilities, it would have been necessary for rates to have been revised upward and the toll business would have been the first to be taken in hand.

During the hearing Mr. Jones presented extended figures to show that the estimated normal increase in revenue on the New England system for 1919 will be $777,800, and that the new toll rates may yield $500,000 more, making a total increase of $1,277,800 against an estimated increase in expenses of $900,000. Mr. O'Brien pointed out that the complexity of the new rates would interfere with the quality of the service, commending the simplicity of the present toll rates.

Mr. Jones pointed out that unless Congress takes further action the government will be obliged to return the telephone system to its owners at the formal conclusion of the war. He informed the commission that in the light of the recent decision of Justice Learned Hand in the case of the Commercial Cable Company versus Postmaster-General it would appear that the President of the United States or his delegated representative has power to modify the rates and practices of the telephone systems as he sees fit, even though there is no claim by the Post Office Department that the proposed rate schedule is a direct war measure.

Chairman Macleod stated that the commission is of the opinion that it has jurisdiction over intrastate toll rates, notwithstanding the federal operation of the telephone properties, and said that as insufficient evidence had been presented to warrant the commission's approval of the new rates, admittedly representing a very substantial increase over present charges, the board ruled that the rates must be suspended. The hearing was adjourned to Jan. 30 to enable the company to present further evidence.

ACTION TAKEN IN OHIO

The Public Utilities Commission of Ohio, in a decision rendered on Jan. 16, rejected by unanimous vote the rate schedules filed by telephone companies operating in that state for long-distance service, as ordered by Postmaster-General A. S. Burleson. According to estimates made by the commission, the new schedules would result in an increase of approximately 25 per cent over the present long-distance charges. Under this decision the new rates cannot go into effect and the authority of the Postmaster-General to issue orders contrary to state laws and regulations will probably be tested in this case. Among the findings of the commission in rejecting the schedules are:

That said proffered schedules contain an entirely new classification of the service which ought not, in the interest of the public, to be instituted without careful consideration supported by evidence of the justness and reasonableness of the same.

That the rates, tolls and charges carried in said proffered schedules are so greatly in excess of the rates, tolls and charges which are now being charged and collected for similar service as to be injurious to the business or interest of the public and ought not to be established and imposed without a satisfactory showing that said enormous increases are necessary and proper.

That the rates, tolls, charges and classifications carried in said proffered schedules do not appear to be based upon any investigation, figures or data showing that such increases are necessary to yield a proper return upon the investment of said companies in their properties used and useful in serving the public in the State of Ohio, but to be arbitrary and imposed for the purpose of creating a uniform standard of rates and charges throughout the United States without giving proper consideration to density of business and the varying conditions and circumstances peculiar to each locality, rather than for the purpose of yielding a just and reasonable return upon the investment.

NEW INTERCONNECTION IS COMPLETED IN CALIFORNIA

California-Oregon Power Company Now Tied in with the Northern California Power System, Effecting Substantial Saving of Oil

The California-Oregon Power Company has just completed the 10,000-kw. link which connects its transmission lines with the Northern California Power Company system. This link involved the reconstruction of 60 miles (96 km.) of line and the construction of 30 miles (48 km.) of new line. It makes possible the transmission of energy from the Copco plant of the former company to the lines of the Northern California Power Company at Kennett. The latter company in turn delivers the energy to the Pacific Gas & Electric Company at Colusa Corners, 200 miles (321 km.) south of the point of generation.

This interconnection ties together on a large-capacity basis all of the important systems in northern California so that there is now interconnected service reaching from the southern part of Oregon to San Francisco. The energy interchanged over the new link is expected to effect a saving of 20,000 barrels of oil annually in San Francisco.

CALIFORNIA COMMISSION SAYS REGULATION STOOD WAR TEST

Necessary Rate Increases—Adjustment of Surcharges with Return to Normal Conditions—Water-Power Development—Federal-Controlled Properties

"The year 1917-18," covered by the report of the California Railroad Commission forwarded by the commission to Governor William D. Stephens, "was one of intense activity and interest due to war conditions," says the letter of transmittal accompanying the report. "Civic, industrial and economic disturbances were all reflected in the activities of utilities, and these disturbances were necessarily in a large measure passed along to and required solution by the commission."

Continuing, the letter says:

It may properly be said that the severest test was put upon public regulation in the period covered by the report, and if, as we believe, such regulation has withstood this test and measured up to the responsibilities and unprecedented needs created by the emergency, the wisdom of the policy of public regulation has been justified.

Many utilities made applications for increases of rates, basing their applications mainly upon increased cost of material, oil and labor—the labor costs making great forward strides on account of increased cost of living and acute competitive labor demands—and increased demand for steam-generated electricity by reason of water shortage. Commenting on these, the commission says:

The commission had no hesitancy in allowing such increases as it deemed proper and reasonable. The commission in its actions believes it fully discharged its duty, not only to the public but to the utilities and national government, by allowing such increases as were necessary to enable the utilities to function efficiently and to prevent financial disaster. This policy is not only just and equitable and consistent with the true spirit of fair public regulations but also responsive to the direct needs of the federal government as expressed in official requests and communications.

Quoting from the statistics of the United States Labor Bureau showing the decrease in the purchasing value of a dollar from 1913 to May, 1918, the figures showing that in May of this year it took $1.91 to equal the purchasing power of the dollar in 1913, the commission points out:

The government, after taking over the railroads, found it necessary to order sweeping increases in all freight and passenger rates on all roads under federal control, which increases were much greater than those made by the commission on other utilities. The average increase of prices for industrial, commercial and domestic products exceeded 50 per cent up to June, 1918. The increase of utility rates did not exceed 15 per cent, on the average. It is a fact, therefore, that the consumer of public utility products in this state was compelled to pay but a very small increase for the commodity and service furnished, as compared with what he was required to pay for all other services and commodities.

The commission speaks in favor of the "surcharges" allowed on existing rates, holding that "increases in cost came so rapidly that it would have been impossible for the commission to give the necessary prompt relief if attempt had been made to have detailed valuations under normal conditions. The factor of time forbade the remedy which a less comprehensive study would show was needed. Adjustment of the surcharges may easily and readily keep pace with the return to normal conditions."

The abnormally low rainfall during the season of 1918, following two unusually dry winters, intensified the problems of the utilities, the close and important relationship of water to most public utility activities brought out by the work of the commission being revealed. In this connection the commission says:

The amount of stored water is immediately related to the amount of electric power that can be generated. A reduction of water available for hydroelectric power immediately demands additional steam-generated electricity to meet demands; steam-generated power connects up immediately with increase in price of oil—the increase ranging from 80 cents a barrel in 1916 to $1.63 at present—and the price of oil to a large degree determines the cost of gas. Water shortage required curtailment of use of water for irrigation purposes. Reduction of delivery brought reduction of income to irrigation utilities, necessitating such increases in rates as would enable the water utility to continue its functions. Increased cost of power in time was visited upon electric street and interurban railroads. Here is a clear instance of how the disturbance of one important operating utility factor immediately affects all other factors with a result that might well be disastrous to consumers in the absence of effective regulation.

That the effect of public regulation was of the greatest possible benefit to the utilities themselves during this period (a period that might well be considered the acid test of the efficiency of regulation) is evidenced by the fact that during that period not a public utility in the State of California went into bankruptcy or receivership. The securities of the California utilities were as well able to withstand the strain of war conditions as were those of any utilities in the nation, and better than many similar utilities and other industries in sister states.

In addition to proposing the legislation which resulted in furnishing water to many thousands of acres, thus accelerating food production, the commission "put into effect a plan under which the electric energy of all companies operating in northern and central California was pooled and directed from one administrative control." The extremely serious power situation early in the year 1918 threatened a breakdown of hydro-

electric activities. The commission called a meeting of the thirty power companies, and the situation was frankly discussed. The representatives of the companies manifested a fine spirit, with the result that, with the concurrence of the utilities, H. G. Butler, assistant chief engineer of the commission, was appointed power administrator, with authority to direct the distribution of power in the best interests of the war emergency. Of the results of this action the commission says:

A survey showed a total load of 5,000,000 kw.-hr. a day, with resources equal to but 4,000,000 kw.-hr. To stimulate production to meet this 20 per cent shortage all steam plants were required to operate twenty-four hours a day, irrigation was lessened wherever possible, and faulty interconnections were corrected. Connections established between the Northern California Power Company and the California-Oregon Power Company, by which electricity generated by the latter company was made available for the pooled companies, were speeded up to be serviceable in October, instead of January of next year.

By the prompt and efficient measures taken by the power administrator the war industries were assured abundant power and the agrarian producers abundant water. The willingness of the utilities to engage in the plan was, we think, an evidence of confidence of the utilities in the Railroad Commission and its staff, because these companies had been business rivals for many years and were, naturally, jealous of their load capacities, connections and strategic positions.

FEDERAL CONTROL OF PUBLIC UTILITIES

Referring to federal control of railroads and telegraph and telephone companies, the commissioners say in part:

It must be remembered that irrespective of whether or not complete control will finally lodge in the federal government, the state will be vitally interested in a great many steam-railroad transportation and rate problems, and the only body through which representation can properly be had is this commission. The commission is still charged by the state constitution and by the public utilities act with jurisdiction over rates, securities, service and practices, grade crossings, interlockers, safety of roadbed and structures, safety of train operation and operating methods, clearances, spur track and interyard connections, valuations and informal complaints.

The question of the jurisdiction of this commission in most of these matters has been formally challenged in proceedings now pending before this as well as other state commissions. No decision was rendered on this question during the progress of the war, but now that the armistice has been signed, the question in so far as it affects this commission in common with other state commissions will of necessity be determined.

If, in the absence of positive legislation by Congress, the Director-General's second alternative (early return of the roads to their owners) should come about, then the commission would within a short time again have to assume complete and unquestioned jurisdiction over state and interstate roads in California. If this happens, not only will there come back again all of the old problems but there will also arise a number of new ones, born during the war, which will be more important and larger than any the commission has had to deal with in this field in the past.

The commission is positive, therefore, that the question to-day is, not to what extent the commission's railroad activities should be further curtailed, but rather how far it should go at this time to prepare and be ready for these new issues which are bound to come before us in one form or another.

Analogous to the railroad situation is the situation with reference to the telephone and telegraph utilities. When the question of the continued jurisdiction of the commission under the new régime came up, the commission entered into direct communication with the Postmaster-General and inquired whether it was his understanding and desire that the commission should continue with its normal functions in relation to these utilities. The Postmaster-General answered that this was his wish and gave it as his interpretation of the federal control law that the commission should exercise all of its functions as heretofore, but that in cases where the commission might see fit to order rate changes they should not be put into effect without his approval.

Under the circumstances the commission has not felt at liberty to discontinue its regulatory work with this class of utilities, and the numerous telegraph cases now before the commission, including the cases involving all of the rates of the Pacific Telephone & Telegraph Company in this state, are being prosecuted as heretofore.

As in the case of the railroads, even if the Postmaster-General's recommendations to Congress for complete federal ownership and operation of wire utilities should be made into law, it would probably still be necessary and desirable for this state to be represented at least during the period of reorganization and adjustment that would as a matter of course precede complete federal ownership. It would be logical that to this commission should fall the task of representing the state's interest in that event.

CAPITAL OF $20,000,000 FOR NEW GENERAL ELECTRIC SUBSIDIARY

International Company Organized with $10,000,000 Preferred and $10,000,000 Common Stock to Take Over Foreign Interests and Export Business

Organization of the International General Electric Company, Inc., has been effected under New York laws with a capitalization of $20,000,000. This is divided between $10,000,000 of 7 per cent cumulative preferred and a like amount of common stock. The stock is paid in and is all held by General Electric interests. All of the foreign interests and export business of the General Electric Company will be under the charge of this company.

The directors are C. A. Coffin, A. W. Burchard, E. W. Rice, Jr., Owen D. Young, J. R. Lovejoy, G. F. Morrison, Gordon Abbott, Sidney Z. Mitchell, George P. Gardner, Charles Neave and Gerard Swope.

As stated recently in the ELECTRICAL WORLD, Gerard Swope is president of the new company and Charles Neave chairman of the board. M. A. Oudin is vice-president of the company.

ADD MEMBERS TO COMMITTEE ON INTERNATIONAL TRADE

Enlargement of Committee of the Associated Manufacturers of Electrical Supplies—Division of Subjects to Facilitate Work

Four additional members were added to the International Trade Committee of the Associated Manufacturers of Electrical Supplies at a meeting of the committee at the association headquarters, New York, on Jan. 15. They are: J. H. Trumbull, Trumbull Electric Manufacturing Company; C. E. Corrigan, National Metal Molding Company; A. F. Hills, Crouse-Hinds Company, and Joseph McElroy III, Pass & Seymour, Inc.

The committee decided to divide its work into two general subjects—the tariff and imports and exports. Members of the committee will be assigned work dealing with different phases of these subjects.

EXPECTS CENTRAL-STATION DEVELOPMENT TO BE RAPID

Fred H. Smith of Worcester, Mass., Looks for Speedy Resumption of Commercial Growth That Was Temporarily Halted by the War

Fred H. Smith, assistant general manager of the Worcester (Mass.) Electric Light Company, looks for an early return of central-station development along commercial lines interrupted by the war.

"At Worcester," said Mr. Smith to a representative of the ELECTRICAL WORLD, "we are fortunate in having plant capacity which can quickly be utilized to meet the increasing requirements of a diversified patronage. As soon as money becomes easier we expect a healthy development in the way of new building work, in the production of commodities needed in civilian life, and in the further popularization of electrical conveniences. The fuel situation with us is now in better shape than for some time. We are busy investigating prospective power customers' conditions and are taking on new business right along.

"Our men in the service will be welcomed to their old posts on their return to civil life. We shall probably continue to use women in our office work in place of male clerks, as this has worked out exceedingly well; but in other departments the need for men will be met by employing men, especially where we can restore those now in the service to our organization. I look to see a gradual reduction in the government's control of industry and feel that good ground exists for optimism in glancing ahead in the central-station field."

WAR LABOR BOARD DECISION IN GENERAL ELECTRIC CASE

Finding Is that Recent Strikes at Schenectady and Pittsfield Were in Violation of Board's Award—Settlement at Pittsfield

C. E. Michael and William H. Johnston, a committee of the National War Labor Board, have rendered a decision in the General Electric Company strike case. It has been approved by the War Labor Board and is as follows:

The undersigned committee, to which has been referred the General Electric Company situation for consideration and report, now makes the following recommendation:

First—With regard to the troubles at Schenectady and Pittsfield, your committee believes that, since this board has made an award at these plants and has provided a means for adjustment of any controversy arising therein, the recent strikes at these plants were in violation of this board's award.

However, since, owing to changed conditions following the cessation of hostilities, the company's production at these plants has been necessarily curtailed with a consequent necessary curtailment of employees, and the company having expressed its willingness to continue operating under the conditions of the award of this board, we recommend that all questions concerning any alleged discrimination either in the curtailment of forces or the restoration of employees who went on strike be referred for consideration and decision to Examiner Stoddard, who is now engaged in the application of this board's award at Lynn, and whose services in this capacity at Schenectady and Pittsfield shall continue for the period of the war or until it may be determined that his presence is no longer necessary; that, at Erie, Pa., where the company has declined to submit to the jurisdiction of the board, as a conciliatory measure your board also will assign an examiner, selected by the undersigned, whose duty it shall be to pass upon any alleged discrimination either in the laying off or restoration of employees, and who shall continue at Erie in such mediatory capacity until withdrawn by the undersigned as a section of this board; that at Fort Wayne, Ind., any controversy that may exist there be referred to the Secretary of Labor for such action as contemplated by an existing agreement between the company and its employees which does not expire until Feb. 1, 1919.

That the examiners at Pittsfield, Schenectady and Erie shall receive instructions from and report to the undersigned as a section of the board, and that any appeal from their decision be referred to this section for consideration and action. That a copy of this recommendation, if adopted, be sent to the company and the representatives of employees at all of the plants of the General Electric Company interested.

STRIKE ENDS AT PITTSFIELD WORKS

The strike which has been in force among employees of the General Electric Company's works at Pittsfield, Mass., since Dec. 20, ended Jan. 19, when the fourteen labor unions affiliated with the Metal Trades Council voted unanimously to accept an agreement reached during the day with General Manager C. C. Chesney and about 1000 strikers who had not been taken back. The employees' committee on appeals, appointed last year under decree of the War Labor Board, reached an understanding with Mr. Chesney and reported back to the unions. It was planned to take back about 350 workers Monday under a preferential list established a fortnight ago by the company. The agreement provides that the company will endeavor to find work for all the remaining employees who went out by Jan. 27. About 4000 employees were involved in the strike, and the estimated cost of the walkout is about $1,000,000, of which $750,000 represents the burden borne by the company.

NEW HAMPSHIRE COMMISSION URGES USE OF WATER POWER

Declares It Is of Great Importance that a Broad Scheme for Conservation of Power Be Undertaken and Encouraged

Water-power development demands increased attention at the hands of the legislators, especially now at the dawn of a new normal era, says the biennial report of the New Hampshire Public Service Commission to the Governor and Legislature of 1919.

Storage reservoirs may readily be established on the headwaters of many, if not all, of the principal rivers, so that the minimum flow may be largely increased and the use of coal to produce electricity in the state may be practically eliminated—a matter of increasing importance to all the inhabitants of the state. The commission says that such a scheme effectively carried out would largely reduce all the higher prices of electricity, resulting in diminished cost of production and a much more nearly universal use.

An extended report on the water-power resources of New Hampshire will be made public. It is written by George B. Leighton, who has been investigating the problem of conservation with the coöperation of C. H. Pierce, district engineer of the United States Geological Survey.

"WELCOME HOME" FOR THE BOYS FROM "OVER THERE"

Society for Electrical Development Stimulating Movement for Bright Electrical Displays to Greet the Homecoming Forces with Cheer

The Society for Electrical Development is calling attention to the "welcome home" movement to cheer the returning soldiers and sailors.

Some idea of the magnitude to which the plan of welcoming the boys home electrically is being carried can be had from these facts regarding the equipment that is being installed for the New York Times Building, which consists of more than 5000 10-watt lamps distributed as follows: The entire building will be outlined with 300 two-foot stars, each star containing eleven lamps, alternating red, white and blue, on a flasher. On the Forty-third Street side, facing Times Square, will be a cluster of Allied flags, surmounted by a spread eagle holding the American shield. This display utilizes 1000 lamps and will measure 40 ft. wide by 24 ft. high. The flags will have a waving effect, and over this will be an electric sign reading "Victory" in 6-ft. letters. At each of the four entrances of the building will be a pair of crossed American flags waving. These will contain 250 lights each. On the roof will be four flashlamps illuminating the American flag flying from the flagstaff.

However, expression of the "welcome home" spirit is not restricted to those only who can go in for large and elaborate displays. Individual dealers, many of whom have neither the facilities nor the means to make a big display, have utilized their windows as the basis for their share in the generally expressed welcome.

In Chicago the Commonwealth Edison Company has taken an active part in the movement to arouse and direct the enthusiasm of business interests, as well as to secure the coöperation of clubs, churches, civic and other bodies. Recommendations to cheer up, paint up, brighten up and light up were scattered broadcast. A series of newspaper advertisements was run in Chicago papers.

The Society for Electrical Development called a meeting of a special committee recently to formulate ways and means to enable the electrical industry to do its share toward making the boys realize that America honors them for their patriotism and is not forgetful of their many sacrifices.

Educational Motion Pictures for Employees of Western Electric Company

The Western Electric Company presented for its employees at the Lexington Theater, New York, on Monday and Tuesday of this week motion pictures dealing with its activities. The films shown were: "Telephone Inventions of To-day," "Forging the Links of Fellowship," "Inside the Big Fence" and "A Square Deal for His Wife."

A Reminiscence of the Last War Loan and a Hint for the Coming Victory Loan

The greatest single factor in the successful prosecution of the campaign for the fourth Liberty loan in Lehigh County, Pa., was the coöperation of the Lehigh Valley Transit Company, according to Reuben J. Butz, of Allentown, chairman of the executive committee. This coöperation assumed the form of supplying a "Liberty tank" and the services of a crew to operate it.

MANUFACTURERS ASK PROMPT ACTION ON THEIR WAR ORDERS

Meeting in Cleveland Results in Organization of Association of Manufacturers of War Materials to Secure Legislation Without Delay

At a meeting of more than 200 manufacturers from all parts of the country at the Hotel Cleveland, Cleveland, Ohio, recently the Association of Manufacturers of War Materials was organized for the primary purpose of taking some action to hasten legislation to validate the so-called informal contracts made by the War Department and the ordnance authorities at a time when materials were needed without delay. These include orders placed by telephone, telegraph and letter. Obligations of the government amounting to more than $1,500,000,000 are included in this list, and manufacturers insist that delay in payment will soon result in industrial disaster.

W. S. Symington, Jr., of the Symington-Chicago Corporation, acted as temporary chairman and was afterward made president of the association.

It was decided, after discussion, to support the Dent bill, now before Congress, with such amendments as will remedy the defects the manufacturers feel it contains. This bill will enable the department that placed the orders to adjust them, thus meeting the desires of the contractors, but in some other respects they will insist upon amendments.

It is intended to align all war contractors in the country with this organization and have their influence for the campaign that is to be made for the legislation desired. Mr. Symington will appoint a board of directors and an executive committee. A paid secretary will also be employed, and a representative of the organization will be maintained at Washington to follow every move that is made. For the present Henry H. Dinneen, Maryland Trust Building, Baltimore, will look after the secretary's duties. He is the secretary of the American Fuse Association.

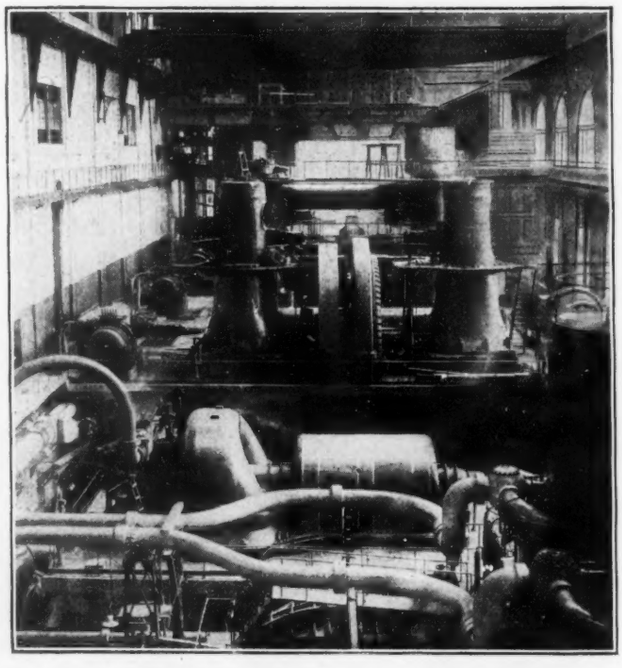
SEEK LARGE MEMBERSHIP FOR RECONSTRUCTED JOVIAN ORDER

Jupiter's Cabinet Considers Proposition to Expand Order Into the National Electrical Board of Trade with Business as Main Activity

An unofficial committee composed of members of the St. Louis Jovian League proposed to Jupiter's Cabinet on Jan. 17 that the Jovian Order be expanded into the National Electrical Board of Trade. It is also proposed to have the activities of the organization primarily business instead of pleasure.

A membership of at least 100,000 is expected, and a change has been suggested in the present optional dues of $2, $5, $10 or $20 per year. The important electrical interests would be asked to guarantee sufficient individual memberships to finance the board during the period in which the plans are being put into effect. When the project gets to be self-supporting all such underwriting payments would be refunded.

Installing 116,000 Kw. in Station Designed for 12,000 Kw.



The Ashley Street plant of the Union Electric Light & Power Company, St. Louis, Mo., was originally laid out to house only three 3000-kw. and two 1500-kw. cross-compound vertical Corliss units, aggregating 12,000 kw. Upon completion of work now in progress there will be installed between the same four walls three 20,000-kw. horizontal, four 12,000-kw. vertical and two 4000-kw. horizontal turbines, or a total capacity of 116,000 kw. The illustration shows the first of the 20,000-kw. turbines in the foreground.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

A. I. E. E., Boston Section.—Dr. Ellwood B. Spear recently gave an illustrated address on "Problems of Gas Warfare" before the Boston Section of the American Institute of Electrical Engineers.

The Synchronous Club.—A feature of the meeting held by the Synchronous Club of Los Angeles, Cal., on Jan. 14 was a talk by G. G. Gillingham on "Submarine Cables and What the Germans Tried to Do with Them."

N. E. L. A., Philadelphia Electric Company Section.—A. H. Manwaring addressed the engineering branch meeting of Jan. 21 held by the Philadelphia Electric Company Section of the National Electric Light Association on the subject of "Transmission."

A. I. E. E., Fort Wayne Section.—Motion-picture films entitled "The Browning Gun," "The Rifle Grenade," "Submarines" and "Fire and Flame" were features of the Jan. 23 meeting of the Fort Wayne Section, American Institute of Electrical Engineers.

Illinois Contractors to Meet in Chicago.—On Feb. 14 and 15 the Illinois State Association of Electrical Contractors and Dealers will hold its semi-annual convention in Chicago. G. A. Engelken, 55 West Harrison Street, Chicago, is secretary of the association.

A. I. E. E., Detroit-Ann Arbor Section.—A paper by John C. Parker on "Fundamental Principles and Calculations of Direct-Current Circuits" was given lately before a meeting of the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers.

Electrical League of Cleveland.—William McClellan, dean of the Wharton School of Finance and Commerce, University of Pennsylvania, addressed the Electrical League of Cleveland on the subject of "Public Utilities and Public Service" at its meeting on Jan. 16.

I. E. S. and A. I. E. E., Philadelphia Sections.—On the evening of Jan. 13 at the Engineers' Club the Philadelphia Sections of the Illuminating Engineering Society and the American Institute of Electrical Engineers held a joint meeting at which Preston R. Millar spoke on "Lighting in War Times."

Pennsylvania State Association of Electrical Contractors and Dealers.—The next meeting of the Pennsylvania State Association of Electrical Contractors and Dealers is scheduled for Jan. 28 at the Hotel Adelphia in Philadelphia. Following open and executive business sessions a dinner will be held in the evening.

A. I. E. E., Schenectady Section.—F. L. Hunt had for his subject "Features of Design and Operation of the Turners Falls Power & Electric Company" at the Jan. 17 meeting of the Schenectady Section of the American Institute of Electrical Engineers.

A. I. E. E., Washington Section.—N. W. Storer was the speaker at the meeting of the Washington Section of the American Institute of Electrical Engineers held on Jan. 14, having for his topic "Electrification of the Chicago, St. Paul & Milwaukee Railway."

Empire State Gas and Electric Association.—At a meeting of the electric distribution section of the Empire State Gas and Electric Association held in Schenectady on Jan. 17 the use of disabled men in distribution work was discussed. Other topics that came in for consideration were transformer loading, the banking of transformers, interconnection of feeders, and methods of marking poles.

A. I. & S. E. E., Philadelphia Section.—John H. Anderson, chief electrical engineer, and H. W. Osgood, electrical engineer of the American International Shipbuilding Corporation of the United States Emergency Fleet, Hog Island, will have for their subject "Electrical Features of Hog Island" at the Feb. 1 meeting of the Philadelphia Section of the Association of Iron and Steel Electrical Engineers, to be held at the Engineers' Club.

Jovian League of Kansas City.—Plans for its greater usefulness both in electrical circles and in civic affairs were announced by President William Hand at the Kansas City Jovian League's first meeting of the new year, held on Jan. 7. The league will this year hold two meetings a month, on the first and third Fridays. It was announced that the first "rejuvenation" since the United States entered the war will take place in February.

Western Association of Electrical Inspectors.—Conservation by standardization will be the chief topic at the annual convention of the Western Association of Electrical Inspectors to be held at the Hotel Sherman in Chicago on Jan. 28, 29 and 30. W. H. Merrill of the Underwriters' Laboratories, Inc., and F. S. Wilhoit of the Cutler-Hammer Manufacturing Company will speak on different phases of this subject. Other speakers at the meetings will be Dana Pierce of the electrical committee of the National Fire Protective Association, on "Making Electrical Rules"; C. W. Babcock, assistant city attorney for Milwaukee, on "The Validity of Ordinances Covering Electrical Matters"; M. G. Lloyd of the Bureau of Standards, on "The Proposed Combined Electrical Fire and Safety Code"; Mr. MacNeill of the Westinghouse Electric & Manufacturing Company, on "A Small-Capacity Circuit Breaker to Take the Place of Fuses," and F. A. Barron of the General Electric Company, on "Time Lag in Motor Protective Devices."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Minimum Charge Decision. — The New York Public Service Commission, First District, has approved an opinion by the chairman, Charles B. Hubbell, and has decided that the Bronx Gas & Electric Company is violating the law in exacting from its electric customers a minimum charge of $1 per month when the total consumption of any single consumer during a particular month multiplied by the rate at which that consumer buys energy does not equal the minimum charge. The maximum price which this company may charge is 12 cents per kilowatt-hour for electricity. Chairman Hubbell found that the imposition of a minimum charge would have the effect in some instances of raising this rate and hence would be illegal. The commission, on the chairman's recommendation, directed that the company remove the minimum charge from its schedules.

Minimum Charge Upheld. — The Pennsylvania Public Service Commission has handed down a decision holding that the public service law of the state allows a minimum charge for electric service as well as a "readiness-to-serve" gas charge. The case at issue was brought by the Borough Council at Lewiston against the Penn Central Light & Power Company protesting against a minimum charge of $1 per month for electric service and 75 cents a month for a readiness-to-serve gas charge. In its decision the commission says: "The reasonableness of minimum schedules has been firmly established and approved in the public service utility law. The use of a separate charge to cover stand-ready costs is very general in electric power schedules, and at the present time the trend is undoubtedly toward a wider use of this form of charge in gas, electric, water and other utilities. The public service utility law does not prohibit its use either directly or indirectly. There is no dintinction in principle between a system of minimum payments and a system of ready-to-serve charges; both are predicated upon the same analysis of total cost of service, and both recognize the element of 'stand ready to serve.' In a schedule with minimum payment requirements the ready-to-serve costs are concealed in the rate per unit, and in the minimum, while in a schedule with a pure ready-to-serve charge these costs are revealed. The commission has not adopted any fixed policy in the matter of a ready-to-serve charge, even though it has in several instances and under certain conditions approved its use."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

"The Synchronous Motor."—*The Synchronous Motor* is the new title of the paper published by the welfare association of the Cleveland Electric Illuminating Company.

Shortage of Coal in Europe Acute.—Coal is scarce in Europe this winter, and behind the scarcity lurks the menace of Bolshevism, a special commission sent abroad by the United States Fuel Administration told Fuel Administrator Harry A. Garfield in a report. No European country has enough coal.

Ohio Commission Overrules Motion for Rehearing in Alliance Rate.—The Public Utilities Commission has overruled a motion for a rehearing filed by the city of Alliance in the case in which the commission fixed the electric rates for the Alliance Gas & Power Company. The city is said to be preparing to appeal to the Supreme Court. The rates were fixed at 12 cents per kilowatt-hour to Jan. 1, 1919, and 10 cents for the following seven and one-half years. The City Council had passed an ordinance fixing the maximum rate at 6 cents.

Development of California Hydroelectric Resources.—Governor William D. Stephens of California says in his message to the Legislature: "Coincident with irrigation expansion will come the development of our wonderful hydroelectric resources. The development of this power will prove a great stimulus to industrial activity. California, by reason of its nearness to the high Sierras, should have the cheapest electrical power in America, and this, together with its unfailing supply of raw materials and its easy access by cheap water transportation to the great markets of the world, should render it in time one of the greatest manufacturing states in the Union."

Toledo Refuses to Allow Service Charge.—On Jan. 8 the City Council at Toledo, Ohio, passed an ordinance reëstablishing the present rate of 8 cents per kilowatt-hour, with a provision for a discount if paid before the tenth of the following month, and a minimum charge of 50 cents. The ordinance extends over the period of one year. In order to increase the income to meet the advanced costs of operation, the Toledo Railways & Light Company had asked that a service fee of 50 cents a month be established, but the Council refused to incorporate this in the contract. Should the company insist, it will now be compelled to go to the Public Utilities Commission and prove that the service charge is necessary.

Prizes on N. E. L. A. Section Papers.—In the Public Service Company of Northern Illinois section of the National Electric Light Association prizes have been awarded for the best papers prepared in competition. The first prize was taken by William Jaeger for a paper entitled "Utility Company Salesmen." The second prize went to George F. Dunn for a paper entitled "Sticking Up," and the third prize was awarded to E. P. Liston for a paper entitled "Looking Ahead."

Federal Order Forbids Waste of Natural Gas.—Wasteful usages of natural gas, such as burning it all day to save the trouble of turning it off, are to be reported hereafter to the United States Fuel Administration, under an order promulgated on Jan. 7. Existing shortages of natural gas may be alleviated in some measure, Fuel Administration officials said, by the order. The natural-gas situation has become steadily worse during the last few years. In many parts of the country at the present moment it is critical; in many communities the consequences during the winter threaten to be serious. The supply is beginning to run short, and only by the greatest vigilance and care can due service be obtained from the quantity available. The losses in connection with use of natural gas are greater relatively than those of any other commodity, and many of these losses can be speedily improved.

To Study Social Status of Engineers.—The Duluth (Minn.) Engineers' Club has appointed a committee to study the question "How can the engineer advance to a more respected and higher plane?" The committee believes a solution of the problem is for independent engineering societies to form a combined engineering society, keeping in mind the importance of not destroying the identity of the present societies but of taking their good points, adding what is new and desirable and getting rid of the undesirable features. The work of the combined organization should be to supplement the work of the separate organizations now existing, taking up questions that they are too busy to handle and centralizing others where combined efforts will bring better results. Technical work and advancement of the arts and sciences would be accomplished in each individual society as at present. The general society would deal with such subjects as the status of the engineer, general welfare, professional ethics, employment agencies, relation of the engineer to the general public, publicity and social benefit. The Duluth committee, which is to ascertain the sentiment of the profession throughout America on the subject, consists of O. H. Dickerson, American Society of Civil Engineers; W. H. Heald, American Institute of Electrical Engineers; O. A. Graves, American Chemical Society; F. H. Linley, American Society of Mechanical Engineers, and D. E. Woodbridge, American Institute of Mining Engineers.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Cannot Refuse Service at Store Because of Overdue Residential Bill.—A public service corporation may not refuse to supply a consumer with electric energy at his place of business merely because he refuses to pay for overdue service at his residence, the two services being distinct, the Supreme Judicial Court of Maine held in Merrill versus Livermore Falls Light & Power Company (105 A. 120).

Electric Light Company Taxable Only on Authorized Business.—Under an act of June 21, 1899, imposing a tax on gross receipts from business of electric light companies, a company is taxable only for receipts derived from the business which it is authorized to transact as an electric light company and not on its receipts from sale of steam and merchandise, the Supreme Court of Pennsylvania held in Commonwealth versus Harrisburg Light & Power Company (105 A. 80).

Assessment of Taxes.—The Chicago drainage canal, constructed primarily for drainage purposes, but used for the production of electric power, is subject to local assessment for taxation, though the canal is used for purposes of navigation under requirements and regulations of the United States government imposed as a condition to the grant of a permit to destroy the Illinois & Michigan Canal for navigation purposes, according to the Supreme Court of Illinois (120 N. E. 818). In assessing the value of the Chicago drainage canal for local taxation, the cost of the improvements, less discount for depreciation, is not the sole criterion of value; but the net earnings from power transmission may be considered.

Right of Legislature Regarding Rules for Electric Wiring.—The Kansas Legislature cannot delegate to private persons or associations the right to make obligatory rules concerning the management of property, nor can it provide that the breach of such rules is a penal offense. Such is the decision of the Supreme Court of Kansas in declaring invalid the section of the fire prevention act providing that theater owners shall be compelled to make electrical wiring conform to the provisions of the National Electrical Code. Complaints had been filed against L. M. Crawford of the Grand Theater, Topeka, because he did not conform to the code, and the lower court decided adversely. The Supreme Court justice expressed the opinion that if the Legislature wished the code to prevail it must pass it as a special law.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Irving Martin has been appointed a member of the California Railroad Commission.

Harley W. Brundige has been appointed a member of the California Railroad Commission.

Walter Rossman, for several years assistant manager at Grand Ledge, Mich., for the Consumers' Power Company, has been promoted to manager, succeeding H. H. Drew.

H. H. Drew, for the last nine years local manager at Grand Ledge, Mich., for the Consumers' Power Company, has been transferred to the Kent (Ohio) Water & Light Company as manager.

C. G. Engstrom, formerly line foreman in the Hutchinson (Minn.) section of the Southwestern division of the Northern States Power Company, has been appointed superintendent to succeed Thomas Pitts.

N. I. Garrison, manager of the El Reno (Okla.) division of the Oklahoma Gas & Electric Company, has been appointed district chairman of the Public Utilities Association for the district around El Reno, embracing twelve counties.

W. Jocelyn E. Dale has resigned from his position as superintendent of power for the Matahambre Copper Mining Company at Santa Lucia, Pinar del Rio, Cuba, to become electrical engineer for the Elia Sugar Company and engineer with the Cuba Cane Sugar Corporation of Havana.

Mortimer Freund, who has been in charge of the trench warfare branch, loading section of the explosives and loading division, Ordnance Department, at Washington, D. C., has resigned from that service and has resumed his activities in the firm of Eadie, Freund & Campbell, consulting mechanical and electrical engineers, New York City.

F. E. Bourget, who for the past thirteen months has been handling the distribution of bituminous coal throughout Ohio, Michigan, Indiana and the West for the Fuel Administration, resigned on Jan. 1, to become identified with the Interstate Coal & Dock Company as special sales agent with headquarters at Cincinnati.

M. C. Gilman, formerly sales manager of the Toronto (Canada) Electric Light Company and for the last few months manager of Willis L. Adams' Montreal office, has joined the staff of the Montreal Light, Heat & Power Company as special agent and research engineer. For a time Mr. Gilman acted as secretary of the Canadian Electrical Association.

E. N. Hurley, chairman of the United States Shipping Board and well known as an electrical manufacturer, it is announced by press dispatch from Pekin, has been decorated by the Chinese government with the order of Chiaoho, second class. The order is confined to civilians and is conferred by the President of the republic for distinguished service.

S. D. Sprong, electrical engineer for the Edison Electric Illuminating Company, of Brooklyn, N. Y., has been appointed chairman of the street-lighting Committee of the Association of Edison Illuminating Companies and also a member of the committee on electricity distribution and use. Mr. Sprong has been associated with the Brooklyn utility in his present capacity for the past seven years, having been prior to that chief electrical engineer of T. G. White & Company, Inc. Previous to that again he was electrical engineer for the United Electric Light & Power Company, New York City, and he had been formerly connected with the New York Edison Company and the Public Service Corporation of New Jersey.

S. D. SPRONG

Peter D. Vroom, who has been editor of the *Doherty Monthly* and *Doherty Daily News* since their inception, has resigned to resume newspaper work. He is succeeded by Thomas B. Pratt, formerly with the publicity department of the New York, New Haven & Hartford Railroad and prior to that with the *Wall Street Journal.*

Lewis Rowe has been appointed superintendent of the municipal light station at Columbus, Ohio. He has been acting superintendent since the resignation of H. E. Eichhorn more than a year ago. Mr. Rowe has been connected with the station since its establishment in 1904 and has installed all the equipment in the plant. For the last four years he has been chief electrician in addition to his other duties. He was connected with the old Columbus Edison Company before it was taken over by the Columbus Railway, Power & Light Company.

William A. Widersmann, manager of the Stanislaus district of the Pacific Gas & Electric Company, has resigned to take up other duties.

John H. Miller, who for the last year was a lieutenant in the Signal Corps at Washington, D. C., in the radio development department, has been released and is now associated with the Jewell Electrical Instrument Company, Chicago, in charge of the engineering department. After graduation from the University of Illinois Mr. Miller was employed by the Westinghouse Electric & Manufacturing Company and was in the detail and supply department of that company for several years before he entered the army.

Charles R. Underhill, until recently captain in the Air Service, Aëronautics, received his discharge from the army on Jan. 8 and has returned to New Haven in the capacity of chief electrical engineer for the Acme Wire Company. For some time Captain Underhill was in charge of tests in flight for the radio development section of the Signal Corps at Langley Field, and when this work started at Little Silver he was transferred to the school for aërial observers at Langley Field, where he organized the radio department and the simulative artillery system. Later Captain Underhill was transferred to the Division of Military Aëronautics, Washington, D. C., where he specified the radio equipment for Air Service operations.

Obituary

Abram T. Baldwin, president of the Precision Instrument Company, Detroit, Mich., died on Jan. 8.

Prof. Rolla C. Carpenter, who until less than two years ago was professor of experimental engineering at Sibley College, Cornell University, which position he had held since 1890, died at his home in Ithaca, N. Y., on Jan. 19 at the age of sixty-seven years. Prior to taking the chair of experimental engineering at Cornell he was professor of mathematics and engineering at the Michigan Agricultural College. At the same time he was consulting engineer for the Lansing Engine & Iron Works, when he designed a governor for the company's automatic engine and made a number of important tests to determine friction losses under various conditions. Professor Carpenter was widely known for his consulting work, particularly that of testing of power-plant units. He did considerable technical writing, and among his works are two well-known textbooks, "Experimental Engineering" and "Internal-Combustion Engines." He was judge in the department of machinery at the Chicago Exposition in 1893, the Buffalo Exposition in 1901 and the Jamestown Exposition in 1907. Professor Carpenter was a member of most of the national engineering societies and was a past-vice-president of the American Society of Mechanical Engineers.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

ELEMENTS OF 1919 FAN DISTRIBUTION PROGRAM

Generally Speaking, 16-In., 12-In. and 9-In. Sizes in Four Blades Are to Be Made Standard for Both Oscillating and Non-Oscillating Types

Arrangements have just about been completed for the 1919 distribution of electric fans. A number of changes are noted from the 1918 fans, although the tendencies that developed at that time are even more pronounced this year. Standardization of electric fans apparently is going ahead rapidly.

The tendency appears to be for the manufacturers to confine their output as nearly as possible to a smaller number of styles. Of course, the 16-in. and 12-in. four-blade fans have virtually been standardized throughout the industry both for oscillating and non-oscillating types. A very strong tendency is seen to replace the smaller sizes with a standard 9-in. four-blade fan in both oscillating and non-oscillating types. There will, however, be a number of 8-in. fans on the market as well as some smaller sizes which are sold on a price basis.

One concern, for instance, that replaced its 6-in. fan with an 8-in. fan two years ago, continued its production of 8-in. fans to the extent that it had parts left over in stock. As soon as the stock of parts of 8-in. fans has been closed out, however, this company will standardize on the 9-in. four-blade type for the smaller sizes. This shows a tendency toward which all manufacturers are drifting.

Ceiling-fan production will come down virtually to one model for alternating current and one for direct current in four blades, plain body, with a 56-in. sweep. The tendency is for anything different from this to be considered special and not carried as a stock article. There may, however, be some departure from this practice, owing largely, it is understood, to stocks on hand. There are, however, some new models in ceiling fans which have departed from the plain body. While more ornamental, they are keeping to the other standards of four blades and 56-in. sweep.

Steel guards will probably be universally used on the 1919 fan output for domestic trade. The tendency is to drift into the use of steel guards also for export trade. There are, however, certain locations which demand a brass guard, and for these the steel guards cannot be used.

The industry had as a result of the ruling of the conservation board prepared to use steel for blades, but this ruling has been withdrawn since the war closed and the chances are that brass blades will be very much in evidence in this market. It is probably true that steel blades would be used more by fan manufacturers were it not for the fact that they must be either brass-plated or japanned. If brass-plated, then there is little difference between the cost of these blades and that of brass blades. If japanned, the japan must be cooled in such a way as to prevent the formation of drops on one side. The formation of these drops, with the high speed of the fan blades, would cause the fans to jump while in operation. Such difficulties have caused the manufacturers to look upon steel blades with less favor.

While 8 ft. of cord attached had virtually become the standard for 1918, still a number of manufacturers last year felt that the trade would be better satisfied with 10 ft. The War Industries Board was of the opinion, however, that 8 ft. was sufficient, and it will probably be found that this year's fans will carry not more than 8 ft. of cord.

Prices have advanced this year around 15 to 20 per cent for the oscillating and non-oscillating types and from around 20 to 25 per cent on ceiling types. There is one concern, however, which has advanced 20 per cent on all fans except ceiling fans, which it has advanced 30 per cent. This concern did not advance its prices as much last year, and the higher advance this year simply brings its products more into line with those of other makes.

The manufacturers found it necessary to increase the price of fans this year for many reasons. All of their raw material had been contracted for and delivered during 1918 or before, and the prices were in excess of those in the previous year. Labor has also gone up and is still up. Also there are high taxes to pay. These were at first placed at 10 per cent, but have later been reduced to 5 per cent, on the selling price of the fan and, of course, have to be incorporated in what the manufacturer charges. It is well known that the manufacturers had decided to charge even higher prices than are now being charged. When the armistice was signed, however, it became apparent that the prices for 1919 must be no higher than absolutely necessary.

LARGE VOLUME OF MOTORS EXPORTED LAST OCTOBER

Official Total of Electrical Exports for Month Is $4,860,392—Exports for the Year 1918 Are Estimated at $60,000,000

Exports of electrical merchandise for the month of October last amount to $4,860,392, or almost $750,000 in excess of October, 1917. Generally speaking, the exports for October, 1918, ran about the same as those for October, 1917. Insulated wire and cable, however, ran somewhat more than $200,000 in excess, and motors went to the high level of $1,147,159.

For the ten months ended with October last the exports of electrical goods amounted to $48,617,293, or a little more than $4,000,000 greater than for the corresponding period for the previous year. At this rate, figures for the entire twelve months of 1918, when available, should be around $60,000,000.

Details of the exports are given in the accompanying table and were compiled by the Bureau of Foreign and Domestic Commerce:

	October		Ten Months Ended Oct.	
	1917	1918	1917	1918
Batteries	$275,721	$276,730	$2,843,770	$2,594,954
Carbons	127,271	114,991	463,451	1,250,382
Dynamos or generators	196,146	254,156	2,054,151	2,719,085
Fans	29,276	15,679	503,514	723,342
Heating and cooking apparatus	63,840	86,144	149,236	556,928
Insulated wire and cables	306,713	525,031	5,798,996	4,739,470
Interior wiring supplies, including fixtures	100,345	83,656	1,030,145	1,175,035
Arc lamps	737	273	14,152	13,737
Carbon-filament lamps	18,023	5,758	152,387	74,218
Metal-filament lamps	240,686	191,344	2,257,575	2,715,756
Magnetos, spark plugs, etc.	283,272	222,099	995,617	2,170,904
Meters and measuring instruments	80,689	83,674	892,870	1,545,994
Motors	546,255	1,147,159	5,145,292	6,636,810
Rheostats and controllers	23,343	30,281	61,188	197,859
Switches and accessories	82,782	124,720	584,679	1,836,686
Telegraph apparatus, including wireless	16,609	19,689	486,960	258,949
Telephones	210,276	148,312	1,705,521	2,377,119
Transformers	224,975	206,575	1,263,625	2,779,377
All other	1,326,014	1,324,121	17,727,486	14,250,688
Total	$4,152,973	$4,860,392	$44,130,615	$48,617,293

LARGE MARKET NOW SEEN FOR INDUSTRIAL HEATING EQUIPMENT

The Impetus Which Was Given to These Devices by War Is Expected to Carry the Demand Forward to Greater Volume of Sales

Industrial electric heating devices bid fair to become a considerable element in the total market for electrical goods. During the war the sale of such equipment was greatly increased and its value as an economic and efficient group of industrial appliances was recognized. Manufacturing facilities were enlarged, many new devices were developed, and a number of new applications were discovered.

Now, however, that the war demand is past, the manufacturers are going into the commercial market with redoubled effort. Furthermore, manufacturers can expect to receive more coöperation from central stations. Already the utilities are making plans to increase greatly the industrial heating load.

There is another factor that must be appreciated, namely, that this market, like others, is cumulative. It is much harder to sell the first than the second installation. Therefore the increased demand that accompanied the war should make for a better and larger market.

METAL MARKET SITUATION

There Is Still No Buying to Be Recorded—Copper Goes a Little Lower

Another drop in copper has occurred since last week. Electrolytic is now reported at 20 cents spot and 19½ cents for first-quarter delivery. There is very little buying, however. The producers' committee was scheduled to leave for Europe this week to study conditions there. Production has fallen off considerably.

Lead is now quoted at 5½ cents by all producers. Spelter softened somewhat in price, as did antimony also. The tin market continues stagnant, waiting for the government to remove its price of 72½ cents.

There is virtually no buying now of any of the metals, either new or scrap. In some lines, such as lead, the bottom prices have been pretty nearly reached, while in others still further reductions are expected. It is this latter condition that is holding up purchases probably more than any other single cause. Manufacturers hesitate to stock raw materials in any large quantity at prevailing prices when there is a possibility that lower quotations are coming. The tendency rather is to reduce supplies on hand as rapidly as possible in order to keep the "loss taking" on a declining market as small as possible.

NEW YORK METAL MARKET PRICES

	Jan. 13	Jan. 21
Copper:	£ s d	£ s d
London, standard spot	94 0 0	91 0 0
	Cents per Pound	Cents per Pound
Prime Lake	23.00*	21.00*
Electrolytic	20.50	20.00
Casting	18.75	18.25
Wire base	22.75*	22.75*
Lead, trust price	6.00	5.50
Antimony	7.75	7.50
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	13.00	13.00
Spelter, spot	7.65	7.35
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent	Govt. price 33.10	Govt. price 33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	16.00 to 16.50	15.50 to 16.00
Brass, heavy	9.00 to 9.50	9.00 to 9.50
Brass, light	7.50 to 8.00	7.50 to 8.00
Lead, heavy	4.50 to 4.75	4.50 to 4.75
Zinc, old scrap	4.75 to 5.00	5.00 to 5.25

* Nominal

THE WEEK
IN TRADE

CURRENT sales are for the most part for immediate requirements. There is little tendency to stock. Jobbers are keeping their stocks down. Still, business for this time of the year is pretty good.

The electric light utilities are beginning to borrow money. A few small lines are being set up, and construction work from this direction appears to be opening up.

Prices are holding remarkably firm. There is a tendency to cut prices here and there in an effort to stimulate business, but it does not appear to be hurting other distributers.

Labor is becoming more plentiful, and a surplus is developing in fifteen or more states.

NEW YORK

Inquiries are a little better, and there appears to be a fair amount of business placed. For the most part it is small-order business for immediate requirements. The tendency to order ahead has disappeared.

Prices are holding pretty firm. Local distributers see no reason for covering them at present because it would hardly be possible to stimulate any building purchases during the months of January and February. Considerable significance is attached to the new conduit discounts which have been lowered on less-than-carload shipments. Wire producers are gradually getting down to a 27-cent to 28-cent rubber-covered wire base.

Surpluses are shown to be increasing, there now being indicated a surplus of about 26,000 in New York State, though a marked shortage of common labor is indicated by the reports. Supply and demand are about equal in New Jersey. Shortages are still marked in Pennsylvania, though decreasing in Philadelphia.

USED MATERIAL.—The War Department reports as of Dec. 1, 1918, the following material on hand at or in transit to docks, camps and ports but not in possession of troops: Electrical material, 772 tons; copper wire, 1030 tons.

PORCELAIN.—Falling prices have been reported in the local papers, but so far as can be learned the price is holding firm with the producers and more reputable jobbers. The reports apparently came from cut-price houses.

ARMORED CABLE.—That a cut is coming has been rumored for the past three weeks, but at this writing the price remains unchanged.

CONDUIT.—Card 41 went into effect Jan. 14. This provides for smaller discounts on less-than-carload shipments. Discounts dropped 1 per cent on 10,000 lb. to carload, 3 per cent on 5000 lb. to 9999 lb., 5 per cent on 2500 lb. to 4999 lb., and 7 per cent on less than 2500 lb.

WOOD POLES.—Northern cedar pole cutters are offering distributers a contract at present prices until June 30. Owing to cutting, freight and labor conditions there appears to be little prospect of any drop in price. There is a possibility, however, that the decision on Monday in the California lumbermen's freight-rate case on shipments east of Denver may be reflected in lower prices to the consumer.

INSULATOR PINS.—Prices on wood insulator pins are beginning to ease off. They were as high as $25 per 1000 but can now be had for $4 to $5 less. Normal price is around $11 to $12 per 1000.

CROSS-ARMS.—Yellow pine has advanced $4.50 per 1000 board feet, which means an increase of about 5 per cent on cross-arms. Fir, used more, has not changed.

WIRE.—Two producers dropped their rubber-covered base since last week. One went from 34 to 28 cents and the

other dropped from 28 to 27 cents. Of thirteen prominent producers on Tuesday, one was on 34 cents, one on 29 cents, six on 28 cents, four on 27 cents and one on cost.

CHICAGO

In the Middle West much thought is being given to making proper prices for electrical goods. There is a feeling that the price finally announced for the next few months should have a wholesome effect on the trade. In high-tension apparatus one manufacturer has in effect guaranteed his present prices against decrease until March 1. He figures that his announcement of this policy will permit him to work up raw-material stocks purchased at high prices and will stiffen the backbones of competing manufacturers. In heating devices the future price situation is somewhat complicated by the fact that there is a difference in price now between what are considered two of the major competing concerns. One of the manufacturers refrained from raising its prices to the new level established by its competitors in 1918.

Actual building thus far started in Chicago is not up to the expectations and promises made earlier in the winter. The reason given is that buildings built in 1914 can rent profitably at $2 per square foot, but that buildings built now would have to rent at $3.90 per square foot to give the same profit.

Public utility financing is proceeding at a pace which gives promise of activity in that field. There are now eleven companies in the State of Illinois petitioning the Public Utilities Commission of Illinois for authority to issue securities. The names of the companies and the amounts are: The Rockford Electric Company, $164,000 bonds and $66,000 preferred stock; Jacksonville Railway & Light Company, $186,000 bonds; Northern Illinois Light & Traction Company, $90,000 bonds; Illinois Central Traction Company, $254,000 bonds; Chicago, Ottawa & Peoria Railway Company, $576,000 bonds; Commonwealth Edison Company, $4,000,000 bonds; Calumet & South Chicago Railway Company, $225,000 notes; Carroll County Independent Telephone Company, $5,457.91 bonds or notes; Chicago Railways Company, $1,995,414 bonds; Aurora, Plainfield & Joliet Railway Company, $200,000 bonds, and the Pontiac Farmers' Telephone Company, $1500 capital stock.

Some jobbers report that the last week has been entirely satisfactory as to volume of business. While it has not been so good as it was in October or November, it was a good week for January. The business came from contractors, industrials and even from central stations. The lamp business has also been brisk.

CONDUIT.—There has been a revision in the scheme of discounts, but no reduction in price was made.

COPPER WIRE.—Prices are spread all the way from 27 cents to 32 cents according to the manufacturer.

LIGHTING FIXTURES.—Bracsolites have been guaranteed against price decreases up to April 1.

APPLIANCES.—Sales are satisfactory in volume. The situation is fraught with some danger because certain distributers with very large stocks may want to sell them rapidly. On the other hand, these distributers may realize that appliances are the one thing that the trade can easily sell during the first six months of 1919.

FARM-LIGHTING PLANTS.—New developments are being made in this field which will be of particular interest to light and power companies.

WASHING MACHINES.—Factories are still crowded to the limit to produce enough machines.

BOSTON

A waiting attitude is still maintained in the trade. Materials of practically all kinds are more plentiful; stocks are not being depleted fast enough to cause any extended buying, and the supply of labor is rapidly increasing. In spite of present dullness, the opinion is practically unanimous that good business cannot long be postponed. It is remarkable to find so much optimism in a period of so little expansion. Prices are still high and predicted reductions are little in evidence. One Boston jobber expressed the wish Monday that prices might come down with a rush, believing that industry would be quickly stimulated thereby. Another large dealer, however, who is carrying about $200,000 in electric motors on his floors, most of which were secured at top prices, looks at the matter from the opposite side. Here and there signs of new building plans are materializing slowly, and vigorous efforts are being made to revive public works projects held up by the war. A large amount of war material is still being produced in New England, and the government has not entirely stopped buying electrical apparatus. The market for small and moderate-sized generators for waterwheel service is coming to life. Appliance sales are fair. Collections are reasonably good, and concerns with good credit continue to meet their obligations promptly. The General Electric strike at Pittsfield has now been settled. Returning service men are being generally taken back into electrical concerns from which they joined the colors. It is pleasing to note that central-station power loads, while somewhat below recent levels, are not falling off at an alarming rate.

MOTORS.—Prices are firm, despite the release of many motors from war plants. Factories are still working on back orders, and shipyards and navy yards are absorbing motors ordered some time since. Stocks are being built up slowly, and some dealers are overloaded. It is hoped that the demand will strengthen soon so that extended price-cutting can be avoided. Industrial inquiries are in small volume at present, and the jobbers are holding off on purchases.

GENERATORS.—Recent sales of machines for water-power plants indicate that a real market is opening up. Public interest in water-power conservation is rising rapidly. The present demand covers units of from 50 kw. to 200 kw., and ninety-day deliveries are being quoted. Northern New England is coming into line for water-power development along modest but highly efficient lines, and the present relatively high cost of generating equipment does not appear to hamper this business much, in view of the exalted prices of coal and labor now current.

CONDUIT.—Pipe is moving into New England in reasonable volume. The wiring market is dull at presnt, but the outlook is good for spring business. Prices are running a bit lower in the central Connecticut valley.

WASHING MACHINES.—Dealers are looking forward to a record-breaking year. Distributers are rapidly getting primed for the expected increase in demand. Sales are in fair volume, despite the usual January breathing spell.

SCHEDULE MATERIAL.—Porcelain and brass are easier as to supply. The factories are still filling back orders. Local business is mainly of the pick-up variety, to fill gaps in jobbers' stocks. Prices are steady without much prospect of early change. The outlook is good, and one representative factory distributer is stocking up on the current price basis in the firm belief that when the demand increases it will come with a rush. January business is showing some improvement over that of last month. On standard products deliveries are now very satisfactory.

WIRE.—The market is slow. Some sales are reported below cost, and prices are rather unsteady.

LAMPS.—Ordinary sizes and types are in good stock. Prices are firm. The miniature-lamp supply is gradually increasing, but time is needed to overcome the effect of war orders on the factory facilities. Buyers can count on better deliveries from now forward, and in two or three months the supply should be nearly normal. The enormous orders placed by the government were little realized by the outside trade during the war, and the manufacturers did well not to permit the market to become absolutely exhausted.

FUSES.—Stocks are heavy and immediate deliveries can be made in nearly all sizes. Fuse prices maintain the low levels illustrated during the war, when acute competition held down the advances which rising production costs would have justified. For this reason distributers state that whatever happens to other material, no declines in fuse prices are to be anticipated for a long period.

ATLANTA

Manufacturers report that the volume of business continues very satisfactory. This week's trade is somewhat below the same period in December. Jobbers and dealers are buying carefully and only in comparatively small quantities for fill-in purposes. A feeling of uncertainty still exists, however, and buyers are waiting for a substantial decline in prices covering standard material. This feeling is further accentuated by the weakening in metal prices. It is thought that after small declines take place in staples the buying element will be able to calculate future reductions and go ahead with plans for larger stocks. It is not probable that Southeastern jobbers' and manufacturers' stocks will be kept up to the point attained in 1918. Copper-wire base has dropped off to about 26 cents.

The effect of holding cotton in the rural districts for a higher price is beginning to be felt in some sections. This is bound to reflect on collections, and while the banking element is to some extent fostering the plan, it is expected that liquidation will take place soon. The Terry Shipbuilding Company, Port Wentworth, Ga., has let contracts for the construction of 120 dwellings to house employees. The Foundation Company, Savannah, Ga., has about completed plans for the installation of an electric power plant.

STORAGE BATTERIES.—The big demand of 1917 for automobile starting and lighting batteries that remained unfilled owing to poor deliveries has carried over to this year. Shipments show a marked improvement. There seems to be no hesitancy in purchasing, and wholesalers state that the volume of sales being transacted at this time indicates a substantial increase over last year.

LAMPS.—Manufacturers report that the activity of last fall continues and the volume of business is about equal to the early part of 1918. The decrease in industrial requirements is offset by the constant orders on government account for cantonments. The insistent call for 40-watt and 60-watt lamps is being taken care of from well-distributed stocks throughout the Southeast. Some difficulty is experienced in securing 75-watt and 100-watt sizes.

SEWING MACHINES.—Dealers and retailers have enjoyed an excellent trade of late, and there is no apparent let-up. Stocks are being well maintained.

FLOODLIGHTING.—While there has been some cessation in the demand for these outfits, the requirement for shipbuilding centers has not been filled and this together with a healthy industrial market, sustains activity. Lamps of 1000 watts are moving freely. Sipments are very good.

CONDUIT.—All sources report a substantial movement of both the black and white product. The decline in certain metals, together with the fact that an Eastern concern is offering quantities three points below the prevailing market, makes for a feeling of hesitancy on the part of some buyers. The trade is looking for a material shade in prices very soon. Shipments are freer and current orders are being filled more promptly.

SEATTLE—PORTLAND

The paramount issue in Seattle to-day is the strike set for Jan. 21 called by the Seattle Metal Trades Council against both wooden and steel shipyards, sub-contract, machine, boiler and allied shops. The strike will affect twenty-one affiliated unions having a membership of approximately 30,000. The authorities state that there is virtually no possibility of heading off the strike. Apparently both sides are as far apart as ever, and no steps are being taken to effect a compromise. The closing down of the shipbuilding industry in Seattle will leave seventy-three uncompleted vessels on ways and in the water, thirty-three steel and forty wooden craft. Electrical workers, about 500, in the shipyards walked out early last week. Work on twenty-five vessels will be halted in Tacoma when approximately 10,000 shipyard workers walk out on Jan. 20 in protest against the Macy scale. Three wooden yards and one steel yard and nineteen allied industries will be tied up. It is believed that the strike will spread up and down the Puget Sound district and to Portland.

Local jobbers refuse to comment on the probable effect on electrical business in case the strike is prolonged. However, as the greater part of electrical jobbing business is carried on with shipyards and similar industrial concerns, results are more or less obvious. Jobbers report no decided increase or decrease. Retailers, however, report a trifling increase in buying over any week since the holidays. Stocks are coming through better, and both jobbers and dealers are taking opportunity to replenish lines which were depleted.

The Norway Pacific Construction & Dry Dock Company, Everett, Wash., has received contracts from the government for five Coast Guard cutters, to cost $3,435,000. Resolutions urging delay in the construction of the proposed million-dollar dry dock in Portland were adopted by the port of Portland commission. Construction of 2000 freight cars for the federal Railroad Administration will be started immediately by the Pacific Car & Foundry Company, Seattle. The contract involves between $6,000,000 and $7,000,000.

Portland territory reports that business in general is simply marking time, awaiting, apparently, the outcome of the peace conference and the action of Congress and various state legislatures before taking any definite steps.

The government spruce production plant at Vancouver, Wash., is collecting electrical and other equipment used by the spruce division in various parts of Oregon and Washington. Quotations are being made on electrical equipment. Just how these prices compare with prices for new machinery of the same type and size is unknown, but the belief is that eventually they are bound to affect the local market.

SAN FRANCISCO

Recent heavy rains are greatly encouraging, bringing up the average fall along the coast and in the central valley to about 20 per cent above normal and averaging about eight times the precipitation at the same time last year. On the other hand, very discouraging reports are received of the snowfall on the high Sierras, and from present indications the power companies will be faced with their 1918 problem of handling the irrigation load.

New buildings reported include a cereal warehouse at Anaheim, a hundred-thousand-dollar hotel at Santa Ana, a two-hundred-thousand-dollar post office at Ventura and new stations and section houses along the Southern Pacific lines in southern California. No big building is announced from northern California, only a number of large dwellings and miscellaneous buildings. The labor situation is quiet, but a big strike of the iron workers has been decreed for February on the basis of back pay under the Macy award.

TAPE.—Big Eastern shipments have arrived, and the stock situation is better although the demand is comparatively small. The prices remain the same, with friction tape running about 30 per cent over the rubber price, a reversal of pre-war conditions.

POLES AND CROSS-ARMS.—The United States government is selling by public auction its spruce-cutting equipment used in the Northwestern forests last year, and the discontinuance of this service will release needed labor for private use. The bane of the pole and cross-arm market last year was the uncertainty of delivery due to the uncertainty of obtaining labor and cars, and it is expected that good stocks will again be distributed along the coast, although at present writing there is little demand for them.

HEATING MATERIAL.—Factories have caught up with their demands and stocks are now moving to the coast, which has been practically cleaned out of such standard commodities as irons and toasters for forty days. There is a brisk demand for radiators in expectation of the last spell of cold weather, which falls in February.

LAMPS.—Stocks are good and demands fair, principally from dealers. Decreased industrial business has caused keen competition for agents' renewals. Flashlamps are overstocked, with a decreased demand. Automobile lamps are still scarce. As usual, all dealers were sold out of Christmas tree outfits during the holidays.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20%
Coil to 1000 ft	List
	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00
	No. 12 Solid
Less than coil	+30% to +20%
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to List
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 36%

BATTERIES, DRY
NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued
CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.44 to $0.45	$0.44 to $0.45
12 to 50	.38 to .39	.38 to .39
50 to barrel	.35 to .362	.35 to .372
Barrel lots	.326 to .332	.326 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅜	250	$5.00
½	250	7.50
¾	100	10.00
1	50	13.00
1¼	50	21.00
1½	50	26.00
2	25–50	35.00
2½	25–50	45.00
3	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25 to $78.75	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅛	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅛-in.—	$25.00–50.70	$24.00–35.20	$23.00–30.25
¼-in.—	30.00–56.40	28.00–38.40	26.00–33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅛-in.—	$60.00	$30.00	$26.00
¼-in.—	65.00	32.50	29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb	7% to 7.1%	9% to 9.1%
2500 to 5000 lb	10% to 10.1%	12% to 12.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb	+5.5% to +3.5%	+3.5% to +1.5%
2500 to 5000 lb	+2.5% to +0.5%	+5% to +1.5%

(I or galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.50 to $7.00
Discount	20% to 25%

CHICAGO

List price	$7.00 to $7.50
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.66
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$32.18—$40.77
Coil to 1000 ft.	28.60— 32.98

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38.00
Coil to 1000 ft.	28.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$33.00

CHICAGO

Net per 100	$33.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	5%
1/5 to std. pkg.	15%
Std. pkg.	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $21.00
1/5 to std. pkg.	17.00 to 17.85

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$21.00–$24.15
1/5 to std. pkg.	17.85– 21.00
Standard package, 2200. List per 1000,	20.00– 21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$16.00	$32.00
1/5 to std. pkg.	13.60	27.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—N.C.	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg.	$13.00–$18.40	$32.00–$36.80
1/5 to std. pkg.	11.50– 16.00	27.20– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 std. pkg.	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%+15%
$10 to $25 list	+10% to 2%
$25 to $50 list	+5 to %5%
	Low Grade
Less than $10 list	+15% to +5%
$10 to $25 list	2% to 8%
$25 to $50 list	5% to 15%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+30% to list
1/5 to std. pkg.	+5% to 10%
Std. pkg.	18%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 18%	Net
$2.00 to $10.00 list	10% to 28%	5%
$10.00 to $50.00 list	20% to 45%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $6.50
Discount	20% to 25%

CHICAGO

List price	$7.00
Discount	20% to 30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.54– $0.66
No. 18, full spools	.52– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.53 to $0.72
No. 18, full spools	.435 to .605

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$18.00–$25.00	$12.50–$17.00	$12.50–$15.00
12	23.40– 27.09	21.06– 23.22	17.55– 23.22
10	32.14– 32.40	28.92– 32.40	23.14– 27.45
8	40.32– 45.72	36.96– 45.72	32.26– 38.10
6	58.52– 72.36	53.20– 60.30	51.07– 57.88

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$24.00–$25.00	$17.50–$18.00	$15.00–$15.50
12	30.48– 31.44	30.48– 31.44	26.67– 31.44
10	42.32– 43.84	42.32– 43.84	37.03– 38.36
8	59.36– 61.76	59.36– 61.76	51.94– 54.04
6	97.68–101.28	85.47– 88.62	85.47– 88.62

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$34.75
25 to 50 lb	34.75
50 to 100 lb	33.75

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$34.76 to $39.75
25 to 50 lb	33.76 to 38.75
50 to 100 lb	32.76 to 37.75

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Instrument Panel for Use with Thomas Meter

To make possible the installation of the recording instruments in a different location from that of the regulating apparatus the Cutler-Hammer Manufacturing Company of Milwaukee has

MAY BE PLACED AWAY FROM THE REGULATOR AND IS EASILY INSTALLED

got out a new instrument panel for use with the Thomas meter. Requiring but little floor space, the new panel may be installed in the superintendent's office so that the total and graphic records of the gas flow may be conveniently referred to while the regulator is at some other point in the plant accessible to inspection by the electrical department.

The new design follows the dead-front principle of switchboard construction and is therefore practically fool-proof and shock-proof. The top section of the panel contains a galvanometer in which the number of sensitive parts is said to have been reduced to a minimum. The necessary sensitive parts have been made easily replaceable, while all other parts are strong and durable. The mechanism and connections are not placed in a wooden but in an aluminum case and are stated to be arranged so that the sensitive parts are well protected and still accessible. The galvanometer is constructed jointly by the Leeds & Northrup company and the Cutler-Hammer company.

The middle section contains an Esterline graphic wattmeter, which records in standard units the flow of gas through the meter housing. Below the Esterline instrument is a Westinghouse single-phase wattmeter showing the total gas flow with a scale calibrated for thousands of cubic feet. Mounted on the back of the center section is a Square D quick knife switch, operated by a lever on the front of the section and serving as a main-line switch for the heater circuit and all control circuits. At the left of this switch a push-button control switch is mounted which operates a C-H single-pole remote-control switch. This switch is opened and closed magnetically and locked mechanically and is used to open the heater circuit in the meter housing, permitting the operator to balance the meter. The instrument panel also contains a current transformer, for all except the small sizes of meters, and fuses for the recording circuits and test connections used in electrically testing the two wattmeters. These wattmeters are standard 5 amp., 110-volt or 220-volt instruments, and therefore may be tested for accuracy in the same manner as other standard indicating or integrating electrical instruments; that is, by connecting them in series with similar meters of known accuracy. Test constants are stamped on each meter, and it is stated that there is no necessity of shutting off the gas or interrupting the gas measurement to test the recording and integrating instruments. All live parts are inclosed in the case upon which the sections of the panels are mounted, and the complete panel is furnished with a cast-iron sub-base, necessitating no other work in installation than the lagging of the base to the floor.

Heavy-Duty Sectional Range

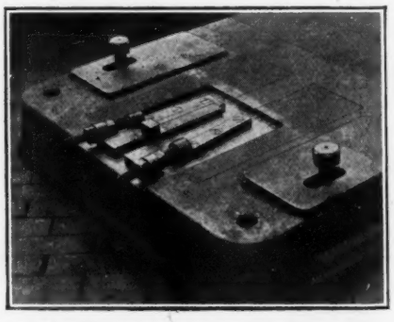
The heavy-duty electric ranges with total connected loads of 19.3 kw. being manufactured by the Simplex Electric Heating Company of Cambridge, Mass., are particularly designed for severe usage in hospitals, hotels, on board ship and in other places where quantity cooking is done. Being built in sections, these ranges may be installed separately or placed side by side according to individual requirements. Four cast-iron inclosed-type heaters are mounted flush with the range top, each being 14 in. (36 cm.) square and removable from the front without using tools. A scavenger pan, also removable, is provided under these top heaters, and the wiring, which is run in conduit, is protected against dripping so that, it is said, even if a kettle were upset on the range no harm would result. Heaters consuming 3.3 kw. on high heat are installed in both the top and bottom of the oven, which has a clear working space 27 in. (69 cm.) deep, 21½ in. (55 cm.) wide and 16 in. (41 cm.) high. The walls are said to be well insulated, and there is a ventilating flue with damper control in the back.

Nickel-chromium resistance wire is coiled in the form of a long spiral and suspended in the heater-plate grooves so that it touches nothing but small strips of mica which support it at short intervals. This heating-element construction is claimed to have two important advantages. The spiral coil makes it possible to get more wire within a limited area, and a larger and stronger wire can be used. Also, the air space between the element and the heater plate takes the place of layers of mica or other electrical insulation, the heat being radiated directly to the heating surface instead of being forced through insulation. Each heater is controlled by a double-pole, three-heat snap switch mounted on the front of the range beside the oven so that all fuses, cut-outs and connections are accessible from the front. Under each switch is a pilot light which remains lighted while the current is on.

An additional feature of this range is a receptacle for receiving an appliance such as a broiler, water urn or rim griddle. This company makes another range identical with the one described except for the top, which consists of smaller units and has no receptacle for portable devices.

Adjustable Anchorage for Motors

To support and align motors from 500 hp. up, and particularly for use



GIVES GREAT FLEXIBILITY IN ALIGNMENT OF MOTORS

with those equipped with magnetic clutches which require a very fine and accurate alignment, an adjustable an-

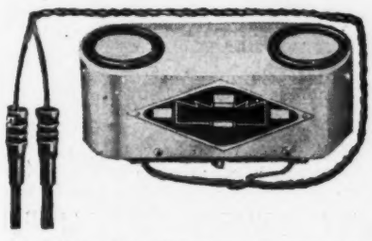
chorage is being manufactured by the Adjustable Anchorage Company, 1502 Ford Building, Detroit. By the use of this anchorage it is possible to move the motor to a limited extent in all directions so that the motor shaft may be accurately aligned with the machine to be driven and so insure proper operation. The device can also be used on motors driving belts. It is claimed that where changes in motor position are required they may be made on the new anchorage in a fraction of the time necessary where motors are dowel-pinned, since when the latter method is used the concrete foundation often has to be destroyed in making changes in position, but with the new device it is merely a matter of adjusting bolts.

The bed plate of the new anchorage is securely fixed in a concrete foundation. Four anchor bolts for engaging the motor base are held in slots so that the motor may be moved from side to side. At opposite ends of the bed plate there is a recess containing a key for holding and guiding the edge of the motor base. Each of these two keys is held between two wedges which, by a nut and stud arrangement, can be moved inward and outward from the edge of the plate. In this way the clamps, the motor and the sliding bolts may be shifted from side to side. The motor may also be rotated slightly by moving only one in each of the two pairs of wedges.

Device for Testing Electrical Circuits

In electrical work it is frequently doubtful whether the current at an outlet is alternating or direct and whether the voltage is 110 or 220. To indicate quickly and easily what kind of current is present the Majestic "determinator" has been developed by the Majestic Electric Development Company of San Francisco. By its use open fuses and circuits may be determined and broken wires or coils as well as bell and lighting circuits may be tested, according to the manufacturers.

To operate the instrument its two plugs, which are of the knife-blade type and constructed to render short circuits



"A.C." OR "D C." SHOWS UP WITHIN THE TWO CIRCLES

or shocks impossible, are placed in contact with the wires or terminals and a button at the bottom of the determinator is pressed. Then, should the current be direct, the letters "D. C." appear within one of the circles at the top of the device, while if alternating current is present "A. C." shows up in the other circle. The brilliancy of the lights back of the letters indicates whether the voltage is 110 or 220.

The new device is conveniently light, weighing only 7 ounces (0.2 kg.), and measures 4 in. (10 cm.) long, 2 in. (5 cm.) high and 1½ in. (3.8 cm.) wide. The maker says it has no delicate or moving parts or fuses and is therefore not likely to get out of order. A wide field of usefulness is claimed for the determinator, it being valuable to wiremen, "trouble shooters," electrical engineers, building superintendents and all others using electricity.

Cast-Iron Storage Hoppers

Adapted to the storage and transfer of ash, sized coal and screenings a line of cast-iron hoppers with unit capacities of from 10 tons to 45 tons and which may be grouped together into manifold hoppers of any desired capacity has been placed on the market by the Green Engineering Company of East Chicago, Ind. In the power plant

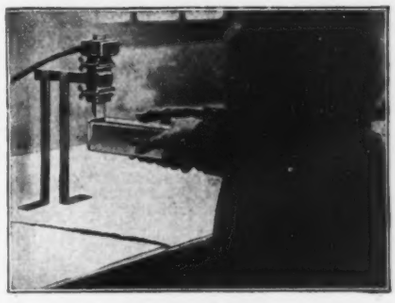
USEFUL IN THE STORAGE OF ASH OR COAL

these hoppers are said to be particularly useful in receiving ashes from steam-jet vacuum conveyors. It is claimed they possess advantages over hoppers constructed of wood, steel or reinforced concrete. The rusting of cast iron is negligible, and the thick metal plates resist the abrasive action of the material being stored. Ease and quickness of erection are said to be outstanding features of these hoppers. The body is composed of sectional cast-iron plates, and the supporting frame is made of standard steel sections which are cut and punched ready for bolting and erection. The cast-iron plate supports are hooked upon the angle struts of the frame, and the cast-iron side and corner plates are slipped into recesses in the sides of these supports. In this way no skilled labor is required in the assembly work, which may be accomplished in a short time.

At the bottom of the hopper is a substantial gate designed for quick discharge and large enough to offset any arcing tendency of the material handled. This hopper gate is mounted upon rollers and is actuated by racks and a chain-operated pinion gear. The chain can be arranged to come on any of the four sides.

Can-Soldering Iron

Ordinary soldering irons are not without disadvantage when used in soldering tin cans for containing foods and other materials. A large heating surface must necessarily be brought



DEVICE FOR SOLDERING CANS

into contact with the edges of the can if any measure of speed in soldering is desired, but the ordinary iron has only a small heated tip. To overcome this obstacle the Cutler-Hammer Manufacturing Company of Milwaukee has developed for special use in soldering cans a large heating surface iron with a rating of 200 watts to 225 watts which is claimed to equal in output the work done by a standard 400-watt iron.

The new iron consists of two type "H" heating units insulated with mica and then covered by a steel jacket placed in close contact with the mica by hydraulic pressure. These heating units are placed on either side of a copper bar and gripped between two iron plates forming a clamp for the bar copper, which is from 1 in. (2.5 cm.) to 1½ in. (3.8 cm.) wide and from ¼ in. (0.63 cm.) to ⅜ in. (0.96 cm.) thick. This flat bar is said to conduct the heat rapidly from the two heating units, a small percentage of heat being lost by radiation or convection. The heating units operate independently of each other and may be renewed separately in case of a burn-out. The iron is supplied with a suitable bracket for bench mounting but may be obtained with a special handle adapting it for hand use if so desired.

Large-Size Vegetable Parer

An electrically operated vegetable-paring machine which is said to have a capacity large enough to meet almost any requirements is being marketed by Redmon, Edgar & Redmon of Cedar Rapids, Iowa. Occupying an approximate floor space of 2 ft. by 2 ft. (5 cm. by 5 cm.), this parer is of substantial construction and rapid operation, being fitted with an adequately sized motor of standard make.

Trade Notes

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A firm in Argentina (No. 28,048) wants an agency for the sale, among other things, of electrical goods.

An agency is desired by a man in France (No. 28,051) for the sale of small electric light plants for farms.

A man in France (No. 28,075) wants an agency for the sale of electrical equipment. Correspondence in French.

Robbins & Myers New District Managers

I. ELKAS, who has been made branch manager for the Robbins & Myers Company at Chicago, is a native of Mississippi. He received his education at the University of Illinois, being graduated with the class of 1898. After spending three years in the cotton-growing business, he opened a contracting and construction business in St. Louis, Mo. In the same city he was for more than eight years the St. Louis manager of the Sprague Electric Works of the General Electric Company. In December of 1914 he resigned to open a sales office for Robbins & Myers. He continued as branch manager at St. Louis until Jan. 1, when he removed to Chicago.

J. F. GALVIN, who was assistant to I. Elkas, St. Louis branch manager for the Robbins & Myers Company, for five years, has been made branch manager to succeed Mr. Elkas.

Edison Electric Appliance Company Appointments

WALTER FAGEN, who has been sales manager of the Hughes division of the Edison Electric Appliance Company, Chicago, has been made sales manager of the Hotpoint division of the same company. Mr. Fagen will also retain an active interest in the development of the goods marketed by the Hughes division.

C. M. LINDSAY, formerly sales manager, Hotpoint Division, Edison Electric Appliance Company, Inc., Chicago, has been appointed as manager of the company's new sales promotion and advertising department. This department has been inaugurated for the sole purpose of building up sales service with customers to the point of highest possible development.

EXPORTATION TO RUSSIA.—The War Trade Board announces that export licenses will be issued to approved consignees for the shipment of all non-conserved comodities to Siberia. It is no longer necessary to consign shipments to that country to the War Trade Board representative at Vladivostok.

WESTINGHOUSE AGENT-JOBBERS' COMMITTEES MEET.—An informal meeting of the active committees of the Westinghouse Agent-Jobbers' Association was held at the Pittsburgh Athletic Club, Dec. 12, 13 and 14. The executive committee received interesting reports from the service committee, also from the committee on channels of distribution. On Thursday evening, Dec. 12, H. D. Shute, vice-president of the Westinghouse Electric & Manufacturing Company, gave a dinner in honor of the visiting Westinghouse agent-jobbers. The dinner was attended by the officials and heads of the departments of the company. General Tripp spoke optimistically of the future and made an appeal for strong cooperation between the company and the agent-jobbers. General Tripp was followed by Dr. Holdsworth, who is the vice-president of the Bank of Pittsburgh and former dean of the School of Finance of the University of Pittsburgh. Dr. Holdsworth talked on "Readjustment of American Business." Walter Cary, vice-president of the Westinghouse Lamp Company, spoke on the lamp situation. The next annual meeting of the association will be held at the Hotel Del Monte, Del Monte, Cal., May 4-11 inclusive. A program for the delegates en route and while at Del Monte is being prepared.

NO LICENSE REQUIRED TO IMPORT WIRING SUPPLIES INTO BELGIUM.—Belgium has just given notice that a large number of items may be imported without license. Included in the list are the following: Electric heaters, arc lamps and parts, incandescent lamps, arc-lamp carbons, wire for electrical installation and insulating tubes, sockets, interrupters, connections and insulators therefor.

SHAFT MANUFACTURER VOICES OPTIMISM.—The Stow Manufacturing Company, Binghamton, N. Y., manufacturer of flexible shafts and tools, has sent to customers an optimistic letter from which the following is taken: "While a brief period of time must elapse before a natural economic and industrial readjustment can be effected, still, speaking for ourselves, we expect to go right along and maintain our large stocks just the same as in the past, believing that any one who shall stop and wait to ask questions impossible of proven answer at this time will forfeit opportunity and would do far better in the long run to just go to work. Our price sheets will keep you fully posted in all price changes in our lines, although we have not yet reached that point when prices are not largely controlled by required deliveries. Personally, we look for a long period of prosperity for the entire country, which we expect to share to a greater extent than ever before."

I. ELKAS

ORGANIZATION OF ITALIAN MACHINERY IMPORTERS.—There has been constituted at Milan, among the most important firms in Italy carrying on an import trade in industrial machinery and machine tools from the allied countries, the Italian Association of Importers and Merchants. The purpose of this organization, as outlined in the statute creating it, is the study, protection and promotion of all those interests appertaining to the importation of the articles mentioned.

GROWTH OF JAPANESE ELECTRICAL MANUFACTURING—Up to five years ago practically all the electrical apparatus used in Japan, according to J. R. Geary, writing in the *Journal of Electricity*, was imported either from America or Europe, 90 per cent coming from the United States. Since then the industry has grown rapidly until at the present time generating units as large as 7000 kw. to 8000 kw. can be turned out in one of the largest factories in from six to seven months. All of the electric lamps, it is stated, used in Japan are made in that country, while a considerable number of those made there are exported. Mr. Geary is of the opinion that in a few more years practically no electrical apparatus will be imported to Japan, because of the ability of Japanese plants not only to turn out all the requirements of the country, but also undoubtedly to be able to export to other countries.

A. H. KELEHER, direct factory representative for export, announces that after Feb. 1 his address will be 44 Whitehall Street, New York City.

THE McGLAUFLIN MANUFACTURING COMPANY, manufacturer of insulator pins, pole tops and the like, formerly at San Rafael, has moved its plant to Petaluma, Col.

GEORGE A. FRENCH, formerly with the Cutter & Wood Supply Company, Boston, acting specially as representative of the Shepard Electric Crane & Hoist Company, has joined the New York sales office of the latter company as sales engineer.

HOMER GREEN, traveling agent for the Mancha Storage Battery Locomotive Company of St. Louis making "the Mancha electric mule," has completed his trip through Missouri and finds the outlook for future business even better than on previous trips.

D. R. G. PALMER, who for the past year has been sales manager of the Habirshaw Electric Cable Company, has resigned to take charge of sales of the A. A. Wire Company, Inc., of Newark, N. J. Mr. Palmer is establishing offices at 50 East Forty-second Street, New York City.

THE BAILY ELECTRICAL SUPPLY COMPANY, 18 Warran Street, New York City, announces that Harry J. Hornung, formerly of E. B. Latham & Company and secretary of the Fullerton Electric Company, has associated himself with the company as general manager and assistant treasurer.

WILLIAM G. CAMPBELL, who has been identified with the conduit and conduit fittings business for a great many years, has severed his former business connections and has been appointed manager of conduit sales for the Central Tube Company, with headquarters at its general offices, First National Bank Building, Pittsburgh.

WALTER F. PFEIFER, who was assistant chief engineer for the Allen Bradley Company, Milwaukee, has been appointed district manager of the Boston territory with offices at 201 Devonshire Street, Room 308. H. B. Boswell, who represented the Allen Bradley Company in Boston, has been appointed district manager for the company's Philadelphia territory.

THE ELECTRIC FURNACE COMPANY, Alliance, Ohio, has just closed a contract with the Braeburn (Pa.) Steel Company, for a large continuous recuperative annealing furnace for annealing alloy steel bars and wire. This furnace will have a capacity for annealing 75 tons of metal per day and an electrical rating of 600 kw. One of the special features of the furnace is that the material is heated and cooled slowly This type of furnace is said to be meeting with favor among the steel mills.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., reports that contracts for 1919 are being concluded practically with all the wholesalers throughout the country handling its fans. As a result stocks of these fans will be available at a great majority of the important jobbing centers. The company says that arrangements have been completed with the Southern Electric Supply Company of Atlanta, Ga., whereby a stock of Emerson and Northwing fans will be maintained by this company in Atlanta during 1919.

THE PACIFIC STATES ELECTRIC COMPANY has been made exclusive Pacific Coast sales agent for the wire products of the Anaconda Copper Mining Company, rolling mills department, of Great Falls, Mont. These products consist of bare copper wire of all kinds, including solid and stranded wire and cables, as well as trolley wire and feeders. This new representation gives the Pacific States Electric Company a high-tension transmission department able to supply complete equipment for transmission-line construction, including poles, cross-arms, hardware and guying material, pins, insulators and copper conductors.

THE AMERICAN ELECTRIC SERVICE & MAINTENANCE COMPANY of Springfield, Mass., rebuilder of electrical machinery, has reorganized its entire business and added much new equipment to its plant a 51 Taylor Street. A. M. Sofield continues as the chief electrical engineer and manager of the company and has associated with him in the work I. P. Sprague as general sales manager, formerly of the Westinghouse Electric & Manufacturing Company; N. S. Monroe, electrical engineer in charge of motor work, and E. S. Allen, in charge of transformer work, both of whom were formerly with the General Electric Company.

THE ELECTRIC MACHINERY COMPANY of Minneapolis, Minn., it is understood, is planning for the erection of a four-story addition, 60 ft. by 80 ft.

R. S. WAKEFIELD, 1312 Great Southern Life Building, Dallas, Tex., has been appointed Texas representative of the Steel City Electric Company, Pittsburgh, Pa.

THE ELECTRIC FURNACE CONSTRUCTION COMPANY, Finance Building, Philadelphia, is reported to have increased its capital from $100,000 to $300,000.

F. A. CLEGG & COMPANY, Louisville, Ky., heating and electrical engineers, announce that Frank E. Good is again associated with them as manager of the electrical department.

IRVING BURROWS has been released from the United States Navy, where he served as an ensign, and will shortly reopen the San Francisco office of the Blaw-Knox Company at 528 Second Street.

R. W. WUSTENFELD, formerly sales engineer for the Manhattan Electrical Supply Company, has been appointed Western manager of electrical trades distribution for the White Sewing Machine Company of Cleveland.

JOSEPH T. RAABA has been promoted by the Eureka Vacuum Cleaner Company from the management of the Akron (Ohio) branch to the management of the St. Louis branch office, with headquarters at 617 Locust Street.

L. P. PROSSEN has resigned as mechanical superintendent of the Black & White Taxicab Company, New York City, and become vice-president of the Nilson-Miller Company of Hoboken, N. J. Mr. Prossen will be in charge of the gear cutting, piston and piston-ring departments.

THE GENERAL INSULATE COMPANY, Brooklyn, N. Y. reports an increase of 50 per cent in the sales of its product in 1918 as against the total for 1917. The company early last year placed its entire force on a profit-sharing basis, under which it distributed dividends this month to all employees.

THE PHOENIX UTILITY COMPANY, 71 Broadway, New York City, is the new name for the Phoenix Construction Company. This company, which handles used machinery and equipment, had its name changed because of the existence of two different construction companies with the same name.

SAMUEL ADAMS CHASE has resumed his duties as special representative of the Westinghouse Electric & Manufacturing Company after an illness of about nine months. He has also resumed his work of editor-in-chief of the company's monthly magazine, which is distributed among the company's agent-jobbers. This publication, formerly called *The Triangle* became *The Circle* with the current issue.

THE WESCO SUPPLY COMPANY salesmen all met in St. Louis on Jan. 2 to 4 inclusive for their annual conference with the officers of the company and representatives of the manufacturers of the lines handled. Capt. Charles Scudder of the Ordnance Department welcomed the men as president of the company and outlined its general policies. General Sales Manager G. H. Cohn was chairman of the meeting. He also entertained the men between business sessions.

BROWN-WHITE, INC., Colonial Trust Company Building, Philadelphia, which it was stated erroneously in the ELECTRICAL WORLD for Nov. 23 had been recently formed to take over the business of the Frank W. Watts Company, was, the company states, incorporated in 1914. The item said that H. R. Smith, district manager of the Electric Machinery Company, had recently joined the Brown-White company. The Brown-White company states that this assertion was also in error.

LIEUT. EDWARD S. HOWE, Engineers, U. S. A., will shortly proceed to the Philippine Islands as a commercial engineering representative of the Westinghouse interests, following honorable discharge from the army. Lieutenant Howe is a native of Kingston, Mass., and was graduated in the electrical engineering course of the Massachusetts Institute of Technology in 1910. After a period of service in the shops and Boston office of the Westinghouse company, he spent two years at Medillin, Colombia, S. A., returning early last year to the United States to enter the national service. He spent eight months in various officers' training camps and received his commission shortly before the close of the war.

Trade Publications

LIGHTING UNIT.—The "Reth-Lite" lighting fixture is described in a folder recently issued by the Retherford Brothers Company of Muncie, Ind.

LIGHTING FIXTURES.—An eighty-page booklet about its lighting fixtures has been prepared by the Jacob-Andreson Company of Minneapolis, Minn.

MICA.—In its catalog No. 100 the Keene Mica Products Company of Keene, N. H., describes the mica insulation and other products of this company.

VACUUM CLEANER.—Its positive suction cleaner with a flexible besom is described in a new folder got out by the May Tag Company of Newton, Iowa.

INSULATING MATERIAL.—Insulating materials made by the Sherwin-Williams Company of Cleveland, Ohio, form the subject of a folder from that company.

SEWING MACHINE LIGHT.—A folder about the "Se-To-So" sewing light is being distributed by the Durkee-Davis Manufacturing Company of Rockford, Ill.

FITTINGS AND SWITCHES.—V. V. fittings and safety switches are described in catalog No. 21, a 127-page publication of the V. V. Fittings Company, Philadelphia.

WATER HEATER.—A folder of the Majestic Electric Development Company, 1705 Allegheny Avenue, Philadelphia, has for its subject an instantaneous electric water heater.

MELTING POT.—An electrically heated metal pot for Intertype machines is described in a booklet prepared by the Intertype Corporation of 50 Court Street, Brooklyn, N. Y.

MARINE FITTINGS.—In a catalog prepared by the Cooley Manufacturing Company of Seattle, Wash., its line of electrical fittings and appliances for use on shipboard is described.

WASHING MACHINE.—A folder which illustrates and briefly describes the electric and the multi-motor styles of its washing machine has been prepared in two colors by the Hirschy Company of Minneapolis, Minn.

LAMP EXTENSION REEL.—A circular descriptive of its automatic extension reel for lamps in garages, factories and other places is being distributed by the Cincinnati Specialty Manufacturing Company of Cincinnati, Ohio.

TRACTORS AND TRUCKS.—Electric tractors and industrial trucks for use in manufacturing plants, freight terminals and warehouses are the subjects of four recently issued bulletins of the Buda Company of Chicago.

COAL-WASHING TABLE.—A bulletin is being distributed by the Deister Concentrator Company of Fort Wayne, Ind., dealing with the No. 7 Deister-Overstrom diagnonal deck coal-washing table by the use of which undesirable impurities are separated from the coal itself.

RUST AND CORROSION PREVENTION.—Protecting iron and steel from corrosion and rusting by the use of the coatings and cleaning preparations made by the Dearborn Chemical Company of Chicago is the subject of a booklet issued by this concern.

THREE-PHASE LOW-TENSION EQUIPMENT.—Bulletin No. 302 is the latest publication of the Delta-Star Electric Company, 2433 Fulton Street, Chicago, having for its subjects unit-type three-phase wiring supports and heavy-duty plugs and receptacles. Illustrations, dimensions, catalog numbers and other information are included.

ELEVATORS AND CONVEYORS.—In its general catalog No. 18, a 480-page publication just prepared by the Gifford-Wood Company of Hudson, N. Y., applications, descriptions and illustrations of this company's elevating and conveying machinery are given together with other information helpful in the solution of handling problems.

SPOT LIGHTS.—In booklet No. 205 recently issued by the Anderson Electric Specialty Company, 118 South Clinton Street, Chicago, the "Autoreelite" an automobile spotlight with a reel which makes it also a trouble light and portable lamp, is dealt with. Extension lights for lamp-socket connection are shown and described.

VALVES.—The Ohio Brass Company of Mansfield, Ohio, illustrates some of its brass valves in a new circular.

LIGHT AND POWER PLANTS.—The Perfection Storage Battery Company, Rhodes Avenue and Fortieth Street, Chicago, is distributing a twenty-four-page catalog about its "Perfection" direct-connected automatic and semi-automatic lighting plants and its "Jupiter" belt-driven sets. Information, specifications and illustrations are given about these plants as well as about lighting fixtures and appliances for use with the sets.

STOKERS.—Two interesting advertising leaflets have been prepared by the Sanford Riley Stoker Company of Worcester, Mass. One, a two-colored folder entitled "Coal Runs the Machinery of Peace," contains a perspective view of the Riley underfeed stoker showing its method of operation, while the other publication tells about the stoker service offered by this company and as illustrations has replicas of the business cards of its various officials and district managers.

ELECTRICAL AND RAILWAY SUPPLIES.—An unusually complete and up-to-date reference book of the products marketed by the Union Electric Company of Pittsburgh, Pa., has been published by that company in the form of a cloth-bound catalog of 1124 pages. The numerous electrical and railway supplies and apparatus made by the many manufacturers for which the Union Electric Company is agent have been illustrated, described and list-priced in this new catalog, No. 8.

MACHINE GUARDS.—The Expanded Metal Engineering Company, 8 West Fortieth Street, New York City, will have ready for distribution in a few days a booklet on "Steelcrete" machine guards which should be of interest to those contemplating the installation of machine guards. The booklet, which is thirty-nine pages in length, tells where guards are usually necessary and what types should be used in individual cases in addition to stating the features of "Steelcrete" mesh guards.

New Incorporations

THE MARINE ELECTRIC COMPANY of New York, N. Y., has been incorporated by H. Scoti, O. E. Miller and R. Elkan, 15 Whitehall Street, New York City. The company is capitalized at $30,000.

THE MAXIM ELECTRICAL CORPORATION of New York, N. Y., has been chartered with a capital stock of $25,000 by S. M. Lnopf, F. F. Buttner and J. Harris, 1547 Broadway, New York, N. Y.

THE SANITARY PHONE CORPORATION of New York, N. Y., has been incorporated with a capital stock of $50,000 by M. L. Abbott, B. D. Colen and V. H. Emerson, 433 Riverside Drive, New York City.

THE NATIONAL ELECTRIC WELDING COMPANY of Philadelphia, Pa., has been incorporated by F. R. Hansell of Philadelphia; E. M. MacFarland and J. Vernon Pimm of Camden, N. J. The company is capitalized at $50,000.

THE LIBERTY LAMP WORKS, INC., of Harrison, N. J., has been incorporated by Daniel J. Delaney and Morris H. Rosenberg. The company is capitalized at $25,000 and proposes to manufacture lamps and scientific apparatus.

THE ANYLITE ELECTRIC COMPANY of Fort Wayne, Ind., has been incorporated by George A. Jacobs, Leonard Sykes and Rhys Davis, all of Forth Wayne. The company is capitalized at $50,000 and proposes to manufacture and deal in all electrical and mechanical appliances and specialties.

THE UNDERWOOD CONTRACTING CORPORATION of New York, N. Y., has been incorporated with a capital stock of $200,000 to do a general contracting and electrical business. The incorporators are: H. T. Underwood of New Orleans, La.; M. Hicks, 149 Broadway, New York City, and H. L. Celler, 850 Kelly Street, the Bronx.

THE AMERICAN BOSCH MAGNETO CORPORATION of New York, N. Y., has been incorporated by S. F. Johnson, W. P. Sheppard and G. H. Hubner, 42 Broadway, New York, N. Y. The company is capitalized at $2,400,000, and proposes to manufacture magnetos, etc. The German-owned Bosch Magneto Company will be absorbed with the works at Springfield, Mass., and Plainfield, N. J.

New England States

BURLINGTON, VT.—Mayor J. Holmes Jackson has signed a contract with the Public Electric Light Company of St. Albans under the terms of which the latter will supply electricity to the city of Burlington for a period of ten years. The plant of the Public Electric Company at Fairfax, it is understood, will be enlarged to provide for the increased service.

CAMPELLO, MASS.—Bids will be received about March 10 by the A. E. Keith Company for the construction of power plant, 64 ft. by 71 ft., to cost about $56,000. Jenks & Ballou, Grosvenor Building, Providence, R. I., are engineers.

WEST DUDLEY, MASS. — Contracts have been awarded for the installation of machinery in the new hydroelectric power plant for the Burmas Paper Company now being erected at West Dudley. The power house will be 45 ft. by 54 ft., the concrete dam 150 ft. long and 10 ft. high. The cost of the plant is estimated at $50,000. Thomas F. McGovern of Southbridge is contractor.

Middle Atlantic States

BROOKLYN, N. Y.—Arrangements have been completed by Julius Kayser & Company, 45 East Seventeenth Street, New York City, for the construction of a new boiler plant at its local works on Classon Avenue, to cost about $50,000.

BROOKLYN, N. Y.—Plans are under consideration by Lindley M. Garrison, receiver of the Brooklyn Rapid Transit Company, for extensions and betterments to the system, calling for an expenditure of about $9,000,000. The proposed improvements will include new electric power stations, to cost more than $3,000,000, the purchase of line and railroad equipment, etc.

BUFFALO, N. Y.—Bids will be received by the City Council until Feb. 4, for the erection of a new cable and wire plant, to be used for municipal purposes, and the installation of a new police signal flashlight system in different city districts. George S. Muck is Mayor.

THIELLS, N. Y.—Bids will be received by F. A. Vanderlip, president of board of managers, Letchworth Village, 7 Wall Street, New York City, until March 4 for building addition to power house, installing equipment and underground piping system, to cost about $300,000. The plans provide for installation of new boilers, piping, feedwater heaters, filters, meters, feed pump, steam turbines, etc. Lewis F. Pilcher of Albany is state architect.

UNION, N. Y.—The Village Board has rejected all bids received for the municipal lighting system. The board is still of the opinion that the lighting system could be operated more advantageously under private management. New bids will be received by the Village Board on March 1 for the municipal lighting plant. John M. Payne is village clerk.

BERNARDSVILLE, N. J.—The Bernardsville Station Garage has contracted with the New Jersey Power & Light Company of Dover to supply electricity for its new garage and repair shop. The building will be about 50 ft. by 175 ft. and will have electrically driven machinery.

GLOUCESTER, N. J.—Plans have been prepared for the installation of four new boilers at the plant of the New York Shipbuilding Corporation.

IRVINGTON, N. J.—Extensions and improvements to the electric street-lighting system are reported to be under consideration by the Town Commissioners.

IRVINGTON, N. J.—Bids will be received by the Board of Education until Feb. 1 for alterations and improvements, including electrical work, at Public School No. 6 on Madison Avenue. A. C. Christian is chairman of the building committee.

MERCHANTVILLE, N. J.—Plans are under consideration by the Borough Council for the installation of a new fire-alarm system in Merchantville.

HARRISBURG, PA.—The board of managers of the Mont Alto Sanatorium is considering plans for the installation of a new electric lighting plant at the institution.

JOHNSTOWN, PA.—The Pennsylvania Central Railway Company contemplates the purchase of one 1200-volt direct-current rotary converter equipment for its power station during 1919.

PHILADELPHIA, PA.—Plans have been filed by the Pennsylvania Railroad Company for the erection of seven new buildings at Greenwich Point, Philadelphia, to cost about $138,000, including a machine shop, to cost $30,000.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

PHILADELPHIA, PA.—Final arrangements have been completed by the City Council for the construction of the proposed new fire house and police station, to be located at Twenty-fourth and Ritner Streets, to cost approximately $350,000.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 31, under Schedule 7702½, for one motor-generator set with switchboard, for Philadelphia yard.

PHILADELPHIA, PA.—Plans have been prepared by the Navy Department (Specification 3682) for the installation of a new pumping unit and auxiliary apparatus in connection with the erection of a number of new buildings at the Government Naval Hospital Reservation.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 3, under Specification 3687, for construction of emergency hospital buildings at Gray's Ferry Road, Philadelphia, to cost about $500,000.

PHILADELPHIA, PA.—An expenditure of approximately $20,000,000 at the League Island, Navy Yard, Philadelphia, is contemplated by the Navy Department, Washington, D. C., including new construction and work now under way. Of this amount $5,000,000 will be used for the construction of a drydock, 210 ft. wide by 1064 ft. long, with arrangements for two vessels at the same time. The dock will be built to carry 35,000,000 gal. of water and provided with a high-pumping system for emptying. A railway system will also be built in connection with dock. Plans include two 900-ft. shipways with six-story machine and structural shop, pattern and storage shops, a forge shop, 300 ft. by 700 ft., a foundry 500 ft. long, and a galvanizing plant, etc., to cost about $3,000,000.

BALTIMORE, MD.—Bids will be asked by the Electric Commission for the purchase of electrical supplies, to cost about $120,000. For further information address C. W. Logan, president of the electric commission, 315 Courtland Street.

MYERSVILLE, MD.—The Hagerstown & Frederick Railway Company of Hagerstown is planning to rebuild its local substation and warehouse. Loss about $7,500.

HAMPTON ROADS, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to rebuild the power plant (recently destroyed by fire) at the local naval operating base.

HAMPTON ROADS, VA.—The Construction Division, War Department, Washington, D. C., is planning improvements and alterations to the Debarkation Hospital No. 51, to cost about $195,000 The plans provide for the erection of nurses' quarters, construction of barracks for enlisted men, mess barracks, diet kitchens, etc.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., in the near future, under Schedule 3646, for furnishing fuses and fuse elements at the Eastern and Western yards.

WASHINGTON, D. C.—Plans for a new naval transport and a repair ship, each of 10,000 tons, have been approved by the Secretary of the Navy. The repair ship represents a modern floating repair plant, consisting of a machine shop, brass and iron foundry, boiler and blacksmith shop, coppersmith shop, pipe and sheet-metal shop, pattern shop and carpenter shop, electrical shop, drafting room, optical shop and gryro-testing room. The ship is about 484 ft. long over all, with a beam of 70 ft. and draft of 19 ft.

North Central States

GRAND RAPIDS, MICH.—Bids, it is understood, will soon be asked for the erection of a T-shaped building for a convent, by the Dominican Sisters, to cost about $350,000.

RAVENNA, OHIO. — The Cleveland, Alliance & Mahoning Valley Railroad Company expects to purchase during 1919 three 200-kva. transformers, an engine lathe, wheel press and boring mill for its substation.

TOLEDO, OHIO.—The stockholders of the Toledo Railways & Light Company have authorized an issue of $3,200,000 in bonds, the proceeds to be used for improvements and extensions to the light and power system. Plans for the proposed improvements are now being prepared.

DAWSON SPRINGS, KY.—Plans are under consideration by the Karlsbad Hotel Company of America for the erection of a hotel, to include casino, sanitarium, club house, bath house, etc., to cost about $4,000,000. W. W. Ahlschlager, 133 West Washington Street, Chicago, Ill., is architect.

MANCHESTER, KY.—H. H. Hardinge, president of the Columbia-Panama Coal Company, is reported to have acquired a site in Goose Creek Valley on which it is proposed to erect a sawmill and rock crusher and also an electric power plant.

MORGANTOWN, KY. — H. Eberman, owner of the local ice plant, is reported to be contemplating the installation of additional equipment, including an electric generator.

ANDREWS, IND.—The capital stock of the Andrews-Largo Telephone Company has been increased from $10,000 to $35,000.

BOSWELL, IND.—The capital stock of the Farmers & Merchants' Coöperative Telephone Company has been increased from $12,000 to $50,000.

DECATUR, IND.—The Commissioners of Adams County have granted the Pleasant Mills Light & Power Company a franchise to erect an electric transmission line from the county infirmary to Pleasant Mills and Bobo. Electricity to operate the proposed system will be secured from the municipal electric plant at Decatur.

HOLTON, IND.—The County Commissioners have granted O. P. Shook, George Struckman and Clarence Steinmetz of Holton a franchise to construct and operate an electric light plant here.

INDIANAPOLIS, IND.—The power plant and drying room of the United States Encaustic Tile Company, West Sixteenth Street, were recently destroyed by fire, causing a loss of about $30,000.

RICHMOND, IND.—Extensive improvements to the municipal electric light plant are reported to be under consideration. D. B. Davis is city engineer.

CHICAGO, ILL.—Plans have been prepared by the Victor Manufacturing & Gasket Company, South Troy Avenue, for the erection of a new plant, 200 ft. by 600 ft. on Twelfth Street, to cost about $250,000.

CHICAGO, ILL.—Contract has been awarded by the Acme Malting Company, 175 West Jackson Boulevard, for the construction of a new power house at Cortland and Kilbourn Avenues, to cost about $15,000.

CHICAGO, ILL.—The Ilg Electric Ventilating Company, 147 Whiting Street, it is reported, has postponed the erection of its proposed factory at Elston Avenue and Snow Street. The cost, including site, is estimated at $750,000.

CHICAGO, ILL.—Plans are under consideration by the trustees of the University of Chicago, 134 South La Salle Street, for the construction of a laboratory and hospital near the Cook County Hospital on the West Side, also hospital on the South Side, to cost about $400,000 each; divinity and administration buildings, to cost about $250,000 each. Plans have been prepared by B. Goodhue, architect, Boston, Mass., for erection of chapel on the university grounds, to cost between $1,500,000 and $2,000,000.

CICERO, ILL.—Walter J. Conlon of the Conlon Electric Washer Company, which manufactures the Western Electric washing machines and other appliances, has purchased a site on the Baltimore & Ohio Chicago Terminal Railroad in South Fifty-second Avenue, on which a plant will be erected, to cost about $250,000. The first unit will contain about 75,000 sq. ft. Two additional units will be added later in the year. Work, it is understood, has begun on the plant. Frank D. Chase, Inc., of Chicago, industrial engineer, has charge of the work.

FREEPORT, ILL.—The Stover Manufacturing Company, it is reported, is planning additions and improvements to its plant, involving an expenditure of about $500,000. W. A. Hance is president.

BEAVER DAM, WIS.—The City Council is considering changing the arc lamps now in use for 60-cp. nitrogen-filled lamps.

BELOIT, WIS.—Plans are under consideration for extension of the ornamental lighting system in Beloit. Arthur Sweet, Palace Building, Milwaukee, is engineer.

GALESVILLE, WIS.—The Davis Mill Company, owner of the local electric light plant, contemplates building an addition to power house and installing a 100-hp. engine. B. W. Davis is manager.

MILWAUKEE, WIS.—Bids will soon be asked by R. E. Oberst, architect, 353 National Avenue, for the erection of a service station, 60 ft. by 127 ft., one story, at 596 Jefferson Street, for the Storage Battery Company, 137 Oneida Street, to cost about $25,000.

PRAIRIE DU CHIEN, WIS.—Application has been made to the City Council by the Mid-Continental Utilities of Lancaster for a franchise to erect an electri transmission line from the city limits to its power plant.

ELK RIVER, MINN.—Plans have been prepared by J. C. Jacobson, 1135 First National-Soo Building, Minneapolis, for the erection of an electric transmission line for the Elk River Power & Light Company. F. D. Waterman is president.

SIOUX CITY, IOWA.—Bids will be received by M. King, president, 634 Davison Building, for the construction of a terminal elevator for the Western Terminal Elevator Company, to cost about $450,000.

SIOUX CITY, IOWA.—The Midland Packing Company, Davidson Building, has awarded general contract for construction of packing plant to Riesche & Sanborn. Bids are being received by Gardner & Linberg of Chicago, Ill., architects, on ice plant, cork insulation for cold-storage building, piping, electrical machinery and electric wiring. The total cost of the plant is estimated at $1,000,000.

FRANKFORD, MO.—The local electric plant of the North Missouri Light & Power Company of New London, it is reported, was recently destroyed by fire.

KANSAS CITY, MO.—The Central Coke & Coal Company of Kansas City is contemplating the purchase of four storage-battery locomotives this spring for use in its mines in Missouri, Kansas and Arkansas.

LOWRY CITY, MO.—The installation of an electric light plant to supply electricity for lighting the business section of the town is under consideration. C. C. Deafenbaugh is reported interested in the project.

ST. LOUIS, MO.—Arrangements are being made by the Inland Machine Company, North Broadway, for the erection of an addition to its plant in the spring, to cost about $150,000.

ATCHISON, KAN.—The Bailor Plow Company, Thirteenth and Utah Streets, contemplates the erection of a new factory, to cost about $250,000. E. V. Jones is secretary.

DOWNS, KAN.—A company to be known as the United Light & Power Company has been organized to build or purchase a central power plant, to be located at Downs, to furnish electrical service in Glen Elder, Cawker City, Downs, Portis, Gaylord and Cedar, Kan. The United Light & Power Company is now negotiating with the Solomon Valley Power Company of Downs for the purchase of its properties. J. G. McClun of Cawker City is president and D. B. Harrison of Downs is treasurer of the new company.

LEAVENWORTH, KAN.—Bids will be received by the Board of Education of Leavenworth, Kan., until Feb. 3 for the erection of an industrial school building at Leavenworth, to cost about $90,000. Separate bids to be submitted on heating, plumbing and electric wiring. T. W. Williamson & Company, Central National Bank Building, Topeka, are architects.

Southern States

ST. STEPHENS, S. C.—The Planters & Builders' Supply Company, it is reported, would like to receive prices on electric plants for farm installation, etc. Frank B. Mansfield is secretary and treasurer.

AUGUSTA, GA.—The City Council has adopted a resolution authorizing Mayor William P. White to appoint a committee composed of three members of the Council and two from the city at large to make investigations relative to the installation of a municipal electric lighting system and the cost of the same.

SAVANNAH, GA.—The Savannah Electric Company is planning to install a 665-hp. boiler at its Riverside power house.

CLARENDON, ARK.—The Commonwealth Power Company, it is reported, contemplates building an electric power plant on the river.

INVERNESS, MISS.—All bids submitted on Jan. 2 for improvements to the municipal electric light plant and water works system have been rejected. New bids, it is understood, will be received in March. The proposed work will include the installation of oil engines, pumps, alternators, miscellaneous line material, cast-iron pipe, hydrants, reservoir, etc. Xavier A. Kramer of Magnolia is engineer.

HOMER, LA.—Bids, it is reported, are being received by George Lewis for equipment for a cotton gin, corn-grinding plant and power plant.

WILBURTON, OKLA.—The Sandstone Coal & Mining Company is reported to be in the market for coal-mining, hoisting and power-plant equipment. T. W. Choat is interested in the company.

FORT WORTH, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 12 for the installation of an electric passenger elevator, etc., in the United States post office and court house in Fort Worth. For details see Searchlight Section.

SAN ANTONIO, TEX.—The power plant of the San Antonio Public Service Company at Villita and South Presa Streets was recently destroyed by fire, causing a loss of about $25,000.

Pacific and Mountain States

CLARKSTON, WASH.—The Lewiston-Clarkston Transit Company contemplates the purchase of a new motor-generator set.

SEATTLE, WASH.—Plans are being prepared by the Pacific Northwest Traction Company for the construction of a building at Sixth Avenue and Olive Street, to cost about $100,000. This building will be erected by the Puget Sound Traction Light & Power Company.

SEATTLE, WASH.—A bond issue for $350,000 for the completion of the construction of the loop of the municipal railway at the plant of the Seattle North Pacific Shipbuilding Company and a bond issue for $200,000 for the East Marginal Way Street Railway for proposed extensions have recently been approved by the Capital Issues Committee.

SEATTLE, WASH.—The construction of two large freight-yard terminals, one to serve Seattle and Tacoma and another to be accessible on the north to Seattle and Everett, will be recommended to the State Public Service Commission of Washington. Tentative plans provide for electrification of all steam rail lines serving the proposed terminals. The plans also call for additional docks and port facilities in the three cities mentioned. The engineering phases of the project are being worked out by R. H. Thomson, former city engineer of Seattle.

TACOMA, WASH.—The Tacoma Municipal Railway is considering the purchase of a 1000-kw. motor-generator set during 1919, also building and equipping a new shop.

TACOMA, WASH.—The city of Tacoma has purchased the Lake Cushman power site on the Skokomish River in Mason County for $300,000. The site embraces 8000 acres.

TACOMA, WASH.—Norton L. Taylor, engineer of the light department, has submitted a report to the City Council relative to creating a storage basin near Elbe. This basin is necessary to allow the Nisqually plant to run at its maximum all the year round. The entire cost of the basin is estimated at $557,960.

KLAMATH FALLS, ORE.—A number of improvements are contemplated by the new City Council, during the year, including a municipal lighting plant and waterworks system. I. B. Struble is Mayor.

KLAMATH FALLS, ORE.—The California-Oregon Power Company, it is reported, is considering the construction of a large dam at the head of Link River for the reclamation of 70,000 acres of land in the Wood River Valley during the present year. George J. Walton is division manager.

REEDSPORT, ORE.—A company has been organized here, to be known as the Reedsport Electric Light Company, to construct and operate an electric light plant. Electricity will be generated at the Johnson mill. Work will begin immediately on the installation of the plant. The company is capitalized at $4,000.

SALEM, ORE.—Warden Stevens of the Oregon State Penitentiary has advised the State Board of Control that the Portland Railway, Light & Power Company has agreed to waive the contract which binds the state to secure all of its lighting service from the company if it is shown that a substantial saving can be made by the installation of equipment to utilize the power which goes to waste during the night while the flax plant is not in operation for lighting penitentiary and asylum. Warden Stevens claims that the cost would not exceed $3,000.

ALAMEDA, CAL.—The Great Western Power Company is extending its system into the city of Alameda through submarine cables into the municipal electric substation recently erected by the city at Pearl Street. This is the second cable extended across the estuary by the Great Western Power Company. The coaling station of the Rolph Shipping Company will use most of the additional power.

RED BLUFF, CAL.—The Council has engaged E. A. Rolinson of Redding to prepare plans for the installation of a new electric lighting system.

SACRAMENTO, CAL.—The city officials, it is understood, contemplate asking for new bids an early date for the construction of the proposed new electrically operated pumping station at the municipal water-works plant.

UKIAH, CAL.—Application has been made to the State Railroad Commission by the Snow Mountain Water & Power Company of Ukiah for permission to issue 7000 shares of capital stock at $5 per share, the proceeds to be used for necessary work and improvements to be made by the company in 1919.

LEWISTON, IDAHO.—Investigations have been made by E. W. Kramer of the hydroelectric department, and I. W. Gerard of the logging department of the United States Forestry Department at Lewiston as to the feasibility of building a dam on the Snake River to develop hydroelectric power for operating lumber mills. It is stated that about 50,000 hp. could be developed at the proposed site.

BRIGHAM CITY, UTAH.—At a mass meeting held recently the City Council was authorized to install a new street-lighting system, to cost about $12,000. The lamp poles now in the middle of Main Street, from Third South to Forest Street, will be removed and ornamental standards erected on either side of the street; also from Main Street to First West on Forest Street.

MANTI, UTAH.—Plans are being considered by the City Council for extensions to the municipal electric system, including enlarging present flume, extensions to distribution system and construction of a hydroelectric plant, to cost about $10,000.

SALT LAKE CITY, UTAH.—The Bamberger Electric Railroad Company is considering the purchase of one automatic substation equipment to convert present manual control.

KALISPEL, MONT.—The Council has adopted a resolution providing for twenty-nine lighting districts in the city.

FORT COLLINS, COL.—Bonds to the amount of $100,000 have been voted for the purchase of the local street-railway system, owned by the Denver & Interurban Railway Company. Of this amount $75,000 will be used to pay for the railway and $25,000 for improvements to the system.

Canada

GRAND PRAIRIE, ALTA.—The Grand Prairie Electric Light Company is contemplating the purchase of a new engine and the installation of an alternating-current system.

LETHBRIDGE, ALTA.—The Lethbridge Municipal Railway Company is contemplating the purchase of a 600-volt, 300-kw., direct-current generator for direct connection to its present engine.

SQUAMISH, B. C.—Plans are being prepared for the provincial government for the installation of a hydroelectric plant at Squamish to supply electricity for lighting and power purposes for the Pacific Great Eastern Railway terminal at Squamish and also for lighting the town. The cost of the proposed plant is estimated at about $40,000.

PETERBORO, ONT.—The Hydro-Electric Power Commission of Ontario is contemplating the construction of a new 1500-kw. rotary substation. The commission operates the Peterboro street-railway system.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 3, under circular 1251, for machine shop equipment, iron and steel cable, wire steel, pneumatic tubes, etc.

(Issued Dec. 10, 1918)

1,287,393. FLASHLIGHT HOLDER; Martin Molnar, Hellertown, Pa. App. filed July 20, 1918. To be supported by the hand so that light may be directed on paper when writing.

1,287,396. ELECTRIC SELECTIVE DEVICE; Arthur H. Morse, London, England. App. filed Sept. 14, 1916. Of the kind comprising a plurality of electromagnetically controlled switching devices set to be operated in succession when a predetermined signal is received, causing the alarm or other electric circuit to be completed only upon the reception of such signal.

1,287,421. CIRCUIT-CONTROLLING TELEPHONE-RECEIVER SUPPORT; William Pick, Scranton, Pa. App. filed Nov. 7, 1914. When the support is in the collapsed position the talking circuit is broken, but when the support is extended the circuit is closed.

1,287,425. ELECTRIC SWITCH; Clarence D. Platt, Bridgeport, Conn. App. filed Aug. 25, 1917. Relates particularly to the compound type wherein a push-button switch mechanism and a rotary snap-switch mechanism are both combined on the same base.

1,287,432. DRIVING SIGNAL; Henry Rabbes, Los Angeles, Cal. App. filed April 25, 1917. For indicating that a vehicle is about to turn or to stop; it is plainly distinguishable from both the front and rear.

1,287,448. SOLDERING TOOL; Claes Ryden, Cranston, R. I. App. filed May 15, 1918. Has an electrically heated point with means for holding a strip of solder to be carried into contact with the point to cause it to be melted and to flow to the joint being soldered.

1,287,449. ELECTRIC LIGHT SOCKET; Alfred C. Ryder, Montgomery, Ala. App. filed April 29, 1918. A threaded plug or the conventional threaded base of an incandescent light can be forced into position within the socket or forcibly withdrawn therefrom without the necessity of screwing it into and out of position.

1,287,451. ELECTRICAL CUT-OUT; Joseph Sachs, Hartford, Conn. App. filed May 25, 1918. Can be used singly or joined together to form two-wire or multiple-wire units for either main-line or branch-line circuits, and provides tap units for connection to or between the single or combined branch-line cut-outs and the circuit wires.

1,287,462. FUSE DEVICE; Edmund O. Schweitzer and Alfred Herz, Chicago, Ill. App. filed Aug. 20, 1915. Especially intended for outdoor overhead work, but also for protective purposes in electric stations as well.

1,287,491. ELECTRIC SWITCH; John F. Spaulding, Melrose, Mass. App. filed March 16, 1917. For automatically starting and stopping motor-operated pumps, compressors and the like, the switch being controlled by the water or air pressure in the receivers filled by the pumps.

1,287,492. INCLOSED ARC LAMP; Thomas Spencer, Philadelphia, Pa. App. filed Jan. 17, 1913. During the operation of the lamp the inner globe is maintained at a temperature sufficiently high to minimize and substantially prevent the obscuration of the inner globe by the deposit of the products of internal combustion.

1,287,522. CIRCUIT BREAKER; Orne H. Torgersen, Chicago, Ill. App. filed June 11, 1917. The circuit breaker is automatically opened in a rapid manner by a predetermined increase in the air pressure in the system.

1,287,542. LAMP MOUNTING; Francis M. Whitney, San Diego, Cal. App. filed Jan. 20, 1915. May be quickly and easily connected to the conductors.

1,287,567. MACHINE FOR WEIGHING WATER; Daniel K. Allison, Cincinnati, Ohio. App. filed July 8, 1916. Especially adapted for use in bakeries where the weight of the flour and water contained in dough is in a definite ratio.

1,287,581. ELEVATOR SYSTEM; Edward L. Dunn, Worcester, Mass. App. filed Aug. 7, 1909. Relates to automatic signaling systems for dumbwaiters or elevators, wherein the car can be sent to any predetermined floor and automatically stopped.

1,287,587. CONDUIT REDUCER AND CONNECTOR; Leonard M. Hickey, Milwaukee, Wis. App. filed Nov. 29, 1916. For underground wires such as telephones, lighting or power-transmission wires.

1,287,598. X-RAY TUBE; Thomas B. Rider, Los Angeles, Cal. App. filed May 10, 1917. To regulate the focus between the cathode and the anode.

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 17, 1918)

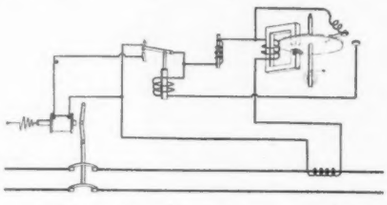
14,572 (reissue). THERMIONIC REPEATER; Alexander McL. Nicolson, New York, N. Y. App. filed Sept. 23, 1914. The input electrode and the cathode are separated by a dielectric film.

14,573 (reissue). WOVEN FABRIC AND PROCESS OF MANUFACTURING SAME; Theodore H. Wickwire, Cortland, N. Y. App. filed April 28, 1914. Produces fabric capable of withstanding the corroding effect of salt air or damp air.

1,287,604. IGNITION LOCK FOR AUTOMOBILES; William Ayling and Alfred A. Ayling, Detroit, Mich. App. filed Nov. 13, 1917. Includes an electric switch, a slide bar for operating the switch and a permutation lock for controlling the operation of the slide bar.

1,287,612. CONDUCTING RIM X-RAY MACHINE; Harry Barnett, New York, N. Y. App. filed May 13, 1916. To produce high-potential and unidirectional as well as oscillatory electric currents for therapeutic use.

1,287,617. ELECTRIC SWITCH; Reuben B. Benjamin, Chicago, Ill. App. filed Dec. 26, 1914. Particularly for closing the



1,287,721—Electric Protective Device

circuit of an electric horn or signaling device on automobiles.

1,287,634. ELECTRIC BATTERY; Newcomb K. Chaney, Lakewood, Ohio. App. filed June 7, 1916. Corrosion of a dry cell is decreased.

1,287,647. ELECTRICAL PROTECTIVE DEVICE; Leslie N. Crichton, Wilkinsburg, Pa. App. filed June 20, 1916. Relates particularly to relay mechanisms and systems employed for tripping circuit interrupters upon the occurrence of predetermined conditions.

1,287,658. ELECTRICAL CONDUCTOR; Charles R. Evans, Akron, Ohio. App. filed March 12, 1917. A durable wearing cover provided for double-conductor cables.

1,287,659. MAGNETO IMPULSER; Ronald K. Evans, Cheboygan, Mich. App. filed July 29, 1918. Relates particularly to mechanisms which produce the maximum current flow or spark introduced into the cylinder or cylinders of the engine by a momentary acceleration of one of the moving parts of the magneto.

1,287,676. ELECTRIC-BATTERY ANODE; Walter Grothe, Fremont, Ohio. App. filed May 15, 1916. Particularly adapted to copper-oxide cells with alkaline electrolyte.

1,287,680. STEERING-WHEEL CONTROL MEANS FOR ELECTRICALLY OPERATED SIGNALS; Roy S. Hanna, St. Petersburg, Fla. App. filed July 26, 1916. Signals on a motor car may be controlled without the driver removing his hands from the steering wheel.

1,287,687. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Aug. 10, 1915. Has special reference to dynamo-electric machines that are adaptable for regeneration and dynamic braking.

1,287,688. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Sept. 9, 1915. Relates particularly to the regenerative control of dynamo-electric machines that are adapted for use in systems of relatively high voltage.

1,287,689. METHOD OF WELDING RAIL BONDS; Albert B. Herrick, Cleveland, Ohio. App. filed March 30, 1917. The resistance across an arc is alternately increased and decreased.

1,287,705. IGNITION SYSTEM; George L. Lang, Newark, N. J. App. filed April 26, 1916. For gas engines in which the source of current supply for ignition is a battery or a direct-current generator ordinarily used for charging the same.

1,287,714. MOTOR-CONTROL SYSTEM; Walter O. Lum, Wilkinsburg, Pa. App. filed Oct. 3, 1913. May be used in connection with planers, elevators and similar machines.

1,287,715. AUTOMATIC SELECTING SWITCH; Frank A. Lundquist, New York, N. Y. App. filed Nov. 27, 1916. Relates to power-driven panel switches of the multi-brush type for use in telephone exchange systems.

1,287,716. AUTOMATIC SWITCH; Frank A. Lundquist, Chicago, Ill. App. filed April 19, 1917. Of the type employed in telephone-exchange systems, and will rapidly select a desired line.

1,287,718. CIRCUIT BREAKER; Samuel C. McKewn, Newark, N. J. App. filed March 15, 1917. For the primary circuit of high-tension ignition systems such as are used in connection with magneto or induction-coil apparatus for internal-combustion engine ignition.

1,287,721. ELECTRICAL PROTECTIVE DEVICE; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed July 3, 1916. Relates particularly to relay mechanisms employed for tripping circuit interrupters upon the occurrence of predetermined circuit conditions.

1,287,722. ELECTRICAL PROTECTIVE DEVICE; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed July 11, 1916. May be operated by current derived from the circuit in connection with which the interrupter is employed.

1,287,725. PROTECTIVE DEVICE; David T. May, New York, N. Y. App. filed May 25, 1917. For protecting electrical circuits from the destructive effects of abnormal currents or impulses.

1,287,734. PROTECTOR FOR TIMER WIRES; Soren J. Norre, Chicago, Ill. App. filed March 30, 1918. For Ford automobiles.

1,287,774. APPARATUS FOR ELECTRIC WELDING; Frank L. Sessions, Lakewood, Ohio. App. filed July 18, 1913. An electrode of indefinite length may be fed continuously automatically at the proper rate of speed to insure the welding of the joint between the juxtaposed edges of two sheets of metal.

1,287,788. ARMATURE WINDING FOR DYNAMO-ELECTRIC MACHINES; Ira B. Stiefel, Wilkinsburg, Pa. App. filed Dec. 6, 1915. To permit a relatively large number of armature conductors of economical cross-section to be placed in each armature slot.

1,287,790. REMOVABLE CONDENSER UNIT FOR MAGNETOS; John F. O. Stratton, Chicago, Ill. App. filed Aug. 21, 1918. Ready accessibility for examination or repair is afforded.

1,287,793. GOLD FILM; Edgar D. Tillyer and Fred M. Bishop, Southbridge, Mass. App. filed May 5, 1917. To be more firm in texture and durable in structure than the present rolled or beaten gold leaf.

1,287,805. TELEPHONE-EXCHANGE SYSTEM; Charles White, East Orange, N. J. App. filed March 8, 1918. Number of circuits required between different switchboards or operators' positions reduced by utilizing the same circuit for various classes of service.

1,287,806. CONTROL APPARATUS; Charles C. Whittaker, Wilkinsburg, Pa. App. filed June 6, 1916. Provides a liquid rheostat of large initial current-carrying capacity that will also have a large resistance range and occupy relatively small space.

1,287,807. PROCESS AND APPARATUS FOR THE ELECTRIC-ARC TREATMENT OF GAS; Frank H. A. Wielgolaski, Christiania, Norway. App. filed Sept. 28, 1916. Products caused to leave the furnace with the highest possible temperature.

1,287,808. STRETCHING OUT DOUBLE OR MULTIPLE ELECTRIC ARC; Frans H. A. Wielgolaski, Christiania, Norway. App. filed Sept. 28, 1916. Method not only constitutes an independent arc-extension method but also will assist elongation of the arc when used in combination with other arc-extending means.